



**SPICER®**

*Off-Highway Products*

## Service Manual

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**Powershift Transmission  
24000 HR 6-Speed  
Long Drop**

**TSM-0066  
April 2000**

## FOREWORD

This manual has been prepared to provide the customer and the maintenance personnel with information and instructions on the maintenance and repair of the Spicer Off-Highway product.

Extreme care has been exercised in the design, selection of materials and manufacturing of these units. The slight outlay in personal attention and cost required to provide regular and proper lubrication, inspection at stated intervals, and such adjustments as may be indicated will be reimbursed many times in low cost operation and trouble free service.

In order to become familiar with the various parts of the product, its principle of operation, trouble shooting and adjustments. It is urged that the mechanic study the instructions in this manual carefully and use it as a reference when performing maintenance and repair operations.

Whenever repair or replacement of component parts is required, only Spicer Off-Highway approved parts as listed in the applicable parts manual should be used. Use of "will-fit" or non-approved parts may endanger proper operation and performance of the equipment. Clark-Hurth Components does not warrant repair or replacement parts, nor failures resulting from the use of parts which are not supplied by or approved by Spicer Off-Highway.

**IMPORTANT :** Always furnish the Distributor with the serial and model number when ordering parts.

### TOWING OR PUSH STARTING

**Before towing the vehicle, be sure to lift the rear wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing.**

**NOTE : If the transmission has 4 wheel drive, disconnect both front and rear drivelines. Because of the design of the hydraulic system, the engine cannot be started by pushing or towing**

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**NOTE:** Metric Dimensions Shown in Brackets [ ].

## HOW THE UNITS OPERATE

The transmission and hydraulic torque portion of the power train enacts an important role in transmitting engine power to the driving wheels. In order to properly maintain and service these units it is important to first understand their function and how they operate.

The transmission and torque converter function together and operate through a common hydraulic system. It is necessary to consider both units in the study of their function and operation.

To supplement the text below, and for reference use therewith, the following illustrations are provided:

### SECTIONAL VIEWS AND PARTS IDENTIFICATION

Basic Design.....	Fig. A
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The R Model consists of a separate torque converter, mounted to the engine with the powershift transmission remotely mounted and connected to the torque converter with a drive shaft.

The shift control valve assembly may be mounted directly on the front transmission cover, or remote mounted and connected to the transmission by means of flexible hoses. The function of the control valve assembly is to direct oil under pressure to the desired directional and speed clutch. A provision is made on certain models to neutralize the transmission when the brakes are applied. This is accomplished through use of a brake actuated shutoff valve. The speed and direction clutch assemblies are mounted inside the transmission case and are connected to the output shaft of the converter either by direct gearing or drive shaft. The purpose of the speed or directional clutches is to direct the power flow through the gear train to provide the desired speed range and direction.

An axle disconnect is optional and is located on the output shaft. The drive to the front or rear axle can be disconnected or connected by manual shifting.

With the engine running, the converter charging pump draws oil from the transmission sump through the removable oil suction screen and directs it through the oil filter and the pressure regulating valve.

The pressure regulating valve maintains pressure to the transmission control cover for actuating the direction and speed clutches. This requires a small portion of the total volume of oil used in the system. The remaining volume of oil is directed through the torque converter circuit to the oil cooler and returns to the transmission for positive lubrication. This regulator valve consists of a hardened valve spool operating in a closely fitted bore. The valve spool is spring loaded to hold the valve in a closed position. When a specific pressure is achieved, the valve spool works against the spring until a port is exposed along the side of the bore. This sequence of events provides the proper system pressure.

After entering the converter housing the oil is directed through the stator support to the converter blade cavity and exits in the passage between the turbine shaft and converter support. The oil then flows out of the converter to the oil cooler. After leaving the cooler, the oil is directed to a lubricating fitting on the transmission and through a series of tubes and passages lubricates the transmission bearings and clutches. The oil then gravity drains to the transmission sump.

The hydraulic torque converter consists basically of three elements and their related parts to multiply engine torque. The engine power is transmitted from the engine flywheel to the impeller element through the impeller cover. This element is the pump portion of the hydraulic torque converter and is the primary component which starts the oil flowing to the other components which results in torque multiplication. This element can be compared to a centrifugal pump in that it picks up fluid at its center and discharges at its outer diameter.

The torque converter turbine is mounted opposite the impeller and is connected to the output shaft of the torque converter. This element receives fluid at its outer diameter and discharges at its center. Fluid directed by the impeller out into the particular design of blading in the turbine and reaction member is the means by which the hydraulic torque converter multiplies torque.

The reaction member of the torque converter is located between and at the center or inner diameters of the impeller and turbine elements. Its function is to take the fluid which is exhausting from the inner portion of the turbine and change its direction to allow correct entry for recirculation into the impeller element.

The torque converter will multiply engine torque to its designed maximum multiplication ratio when the output shaft is at zero RPM. Therefore, we can say that as the output shaft is decreasing in speed the torque multiplication is increasing.

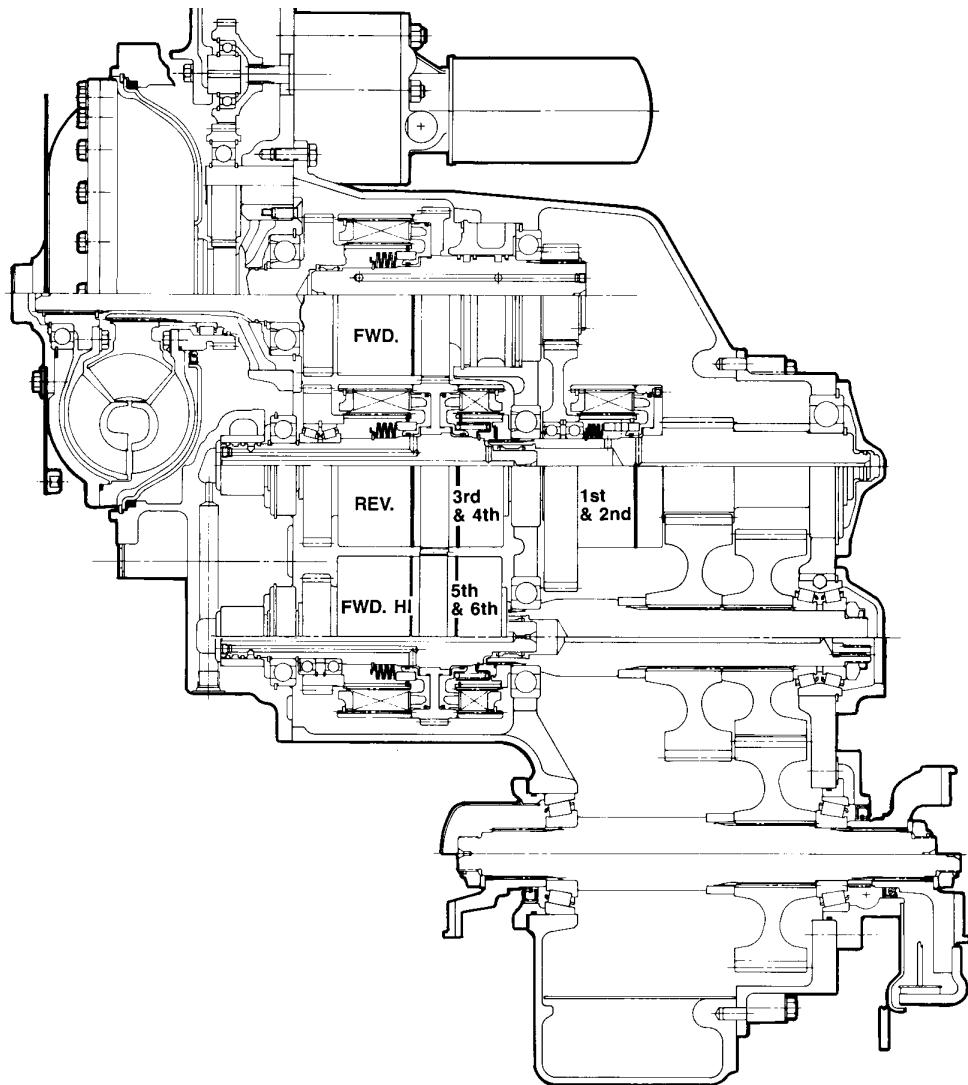
The shift control valve assembly consists of a valve body with selector valve spools. A detent ball and spring in the selector spool provides one position for each speed range. A detent ball and spring in the direction spool provides three positions, one each for forward, neutral and reverse.

With the engine running and the directional control lever in neutral position, oil pressure from the regulating valve is blocked at the control valve and the transmission is in neutral. Movement of the forward and reverse spool will direct oil, under pressure to either the forward or reverse direction clutch as desired. When either directional clutch is selected the opposite clutch is relieved of pressure and vents back through the direction selector spool. The same procedure is used in the speed selector.

The direction or speed clutch assembly consists of a drum with internal splines and a bore to receive a hydraulically actuated piston. The piston is "oil tight" by the use of sealing rings. A steel disc with external splines is inserted into the drum and rests against the piston. Next, a friction disc with splines at the inner diameter is inserted. Discs are alternated until the required total is achieved. A heavy back-up plate is then inserted and secured with a snap ring. A Hub with O.D. splines is inserted into the splines of discs with teeth on the inner diameter. The discs and hub are free to increase in speed or rotate in the opposite direction as long as no pressure is present in that specific clutch.

To engage the clutch, as previously stated, the control valve is placed in the desired position. This allows oil under pressure to flow from the control valve, through a passageway, to a chosen clutch shaft. This shaft has a drilled passageway for oil under pressure to enter the shaft. Oil pressure sealing rings are located on the clutch shaft. These rings direct oil under pressure to a desired clutch. Pressure of the oil forces the piston and discs against the heavy back-up plate. The discs, with teeth on the outer diameter, clamping against discs with teeth on the inner diameter, enables the hub and clutch shaft to be locked together and allows them to drive as a unit.

There are bleed balls or bleed orifices, depending upon the model, in the clutch piston which allow quick escape for oil when the pressure to the piston is released.



HR 24000 .6 SPEED TRANSMISSION

FIGURE A

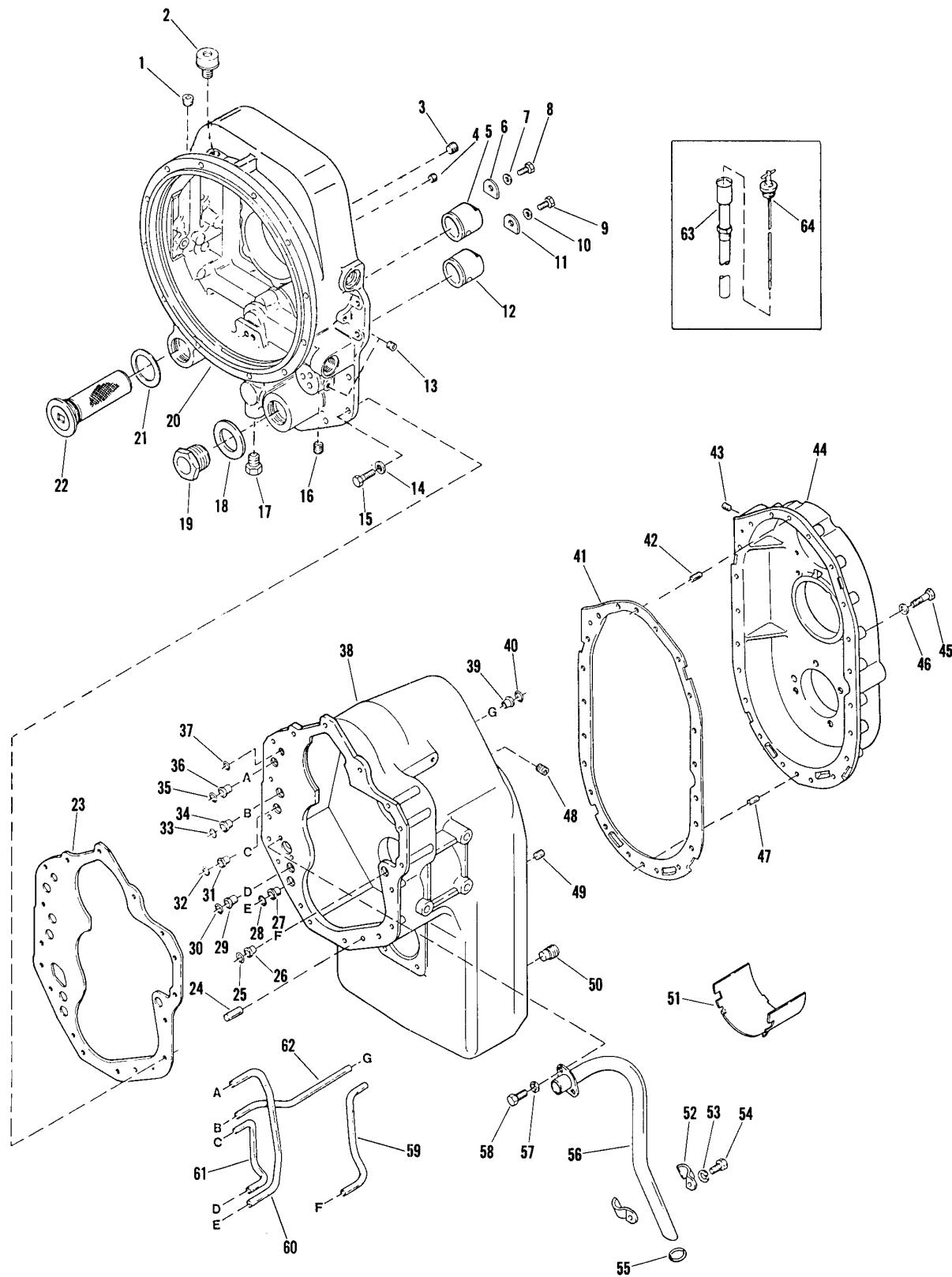


FIGURE B

## CONVERTER AND TRANSMISSION CASE GROUP

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Pipe Plug.....	2	33	Clutch Pressure Tube "O" Ring .....	1
2	Air Breather.....	1	34	Tube Sleeve .....	1
3	Pipe Plug.....	1	35	Clutch Pressure Tube "O" Ring .....	1
4	Pipe Plug.....	2	36	Tube Sleeve .....	1
5	Converter Housing Sleeve.....	1	37	Clutch Pressure Tube "O" Ring .....	1
6	Clip .....	1	38	Transmission Case Assembly .....	1
7	Clip Screw Lockwasher.....	1	39	Tube Sleeve .....	1
8	Clip Screw.....	1	40	Clutch Pressure Tube "O" Ring .....	1
9	Clip Screw.....	1	41	Rear Cover to Transmission Case Gasket.	1
10	Clip Screw Lockwasher.....	1	42	Transmission Case to Rear Cover Dowel Pin .....	1
11	Clip .....	1	43	Rear Cover Pipe Plug.....	1
12	Converter Housing Sleeve.....	1	44	Rear Cover .....	1
13	Pipe Plug.....	2	45	Rear Cover to Case Screw.....	20
14	Converter Housing to Transmission Case Screw Lockwasher .....	17	46	Rear Cover to Case Screw Lockwasher...	20
15	Converter to Transmission Case Screw.....	17	47	Transmission Case to Rear Cover Dowel Pin .....	1
16	Pipe Plug.....	2	48	Pipe Plug.....	1
17	Plug .....	1	49	Pipe Plug.....	1
18	Hole Plug Gasket.....	1	50	Magnetic Drain Plug .....	2
19	Case Assembly Hole Plug .....	1	51	Oil Baffle .....	1
20	Converter Housing .....	1	52	Tube Clip.....	2
21	Screen Assembly Gasket.....	1	53	Clip Screw Lockwasher.....	1
22	Screen Assembly .....	1	54	Clip Screw.....	1
23	Converter Housing to Transmission Case Gasket .....	1	55	Suction Line Assembly "O" Ring .....	1
24	Converter Housing to Case Dowel Pin ...	1	56	Suction Tube Assembly.....	1
25	Clutch Pressure Tube "O" Ring .....	1	57	Screw Lockwasher.....	2
26	Lube Tube Sleeve.....	1	58	Suction Line Screw .....	2
27	Tube Sleeve .....	1	59	Clutch Lube Tube.....	1
28	Clutch Pressure Tube "O" Ring .....	1	60	3rd Speed Tube .....	1
29	Tube Sleeve .....	1	61	High Speed Clutch Pressure Tube .....	1
30	Clutch Pressure Tube "O" Ring .....	1	62	Low Speed Clutch Pressure Tube.....	1
31	Tube Sleeve .....	1	63	Dipstick Tube Assembly .....	1
32	Clutch Pressure Tube "O" Ring .....	1	64	Dipstick .....	1

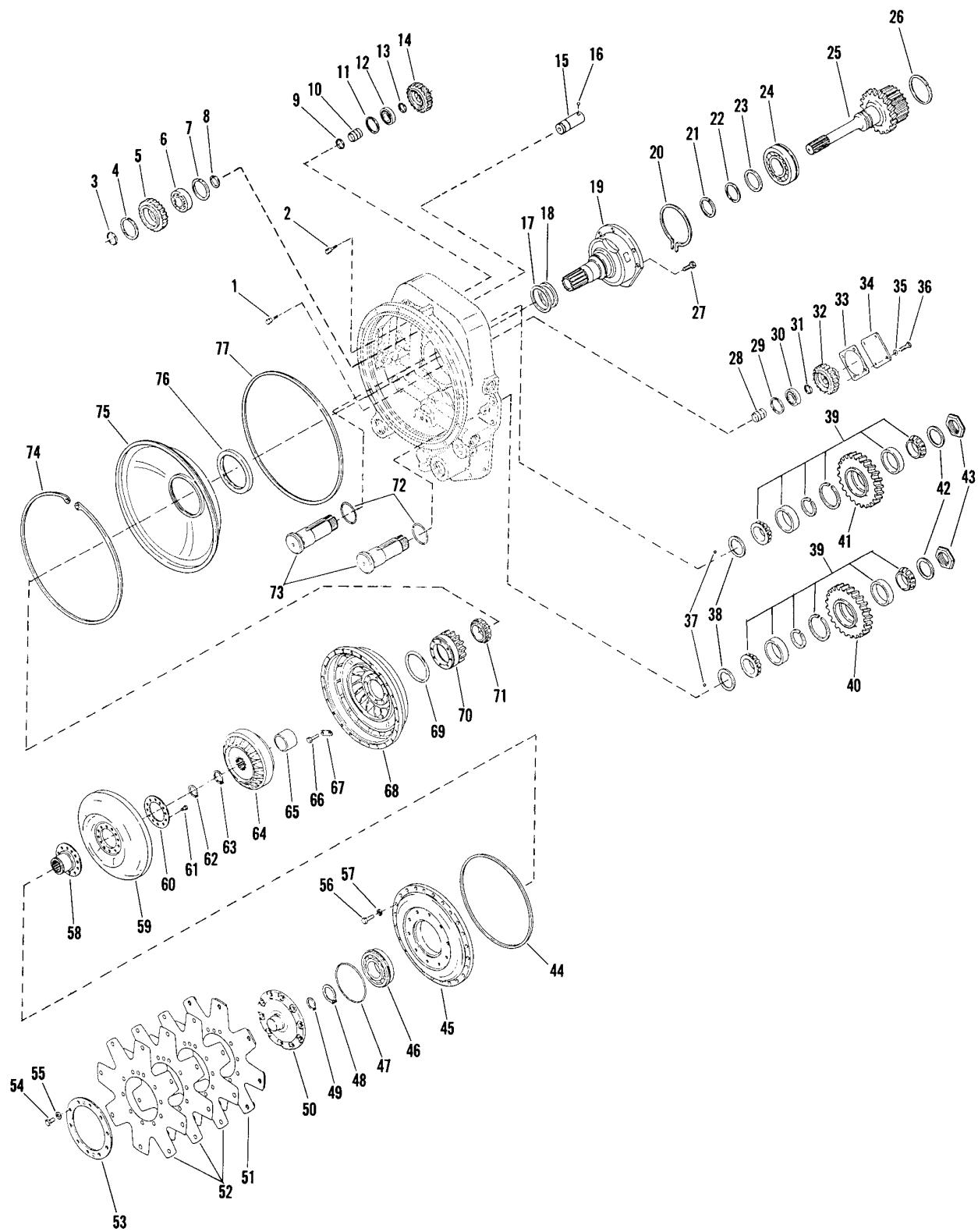


FIGURE C

## CONVERTER AND PUMP DRIVE GROUP

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Bearing Support Screw & Lockwasher .....	2	39	Reverse Idler Gear Bearing Assembly .....	2
2	Bearing Support Screw & Lockwasher .....	2	40	Reverse Idler Gear - Lower Shaft.....	1
3	Idler Gear Bearing Locating Ring.....	1	41	Reverse Idler Gear - Upper Shaft.....	1
4	Idler Gear Bearing Retaining Ring.....	1	42	Reverse Idler Gear Bearing Thrust Plate .....	2
5	Pump Drive Idler Gear.....	1	43	Bearing Retaining Plate Nut.....	2
6	Idler Stub Shaft Bearing .....	1	44	Impeller to Cover "O" Ring.....	1
7	Bearing Retaining Ring .....	1	45	Impeller Cover .....	1
8	Bearing Locating Ring.....	1	46	Turbine Hub Bearing .....	1
9	Bearing Locating Ring.....	1	47	Impeller Cover to Bearing Cap "O" Ring.....	1
10	Pump Drive Bearing Support.....	1	48	Turbine Hub Bearing Retaining Ring .....	1
11	Bearing Retaining Ring .....	1	49	Turbine Retaining Ring .....	1
12	Pump Drive Gear Bearing .....	1	50	Impeller Cover Bearing Cap .....	1
13	Bearing Locating Ring.....	1	51	Drive Plate Assembly.....	1
14	Pump Drive Gear .....	1	52	Drive Plate .....	3
15	Idler Gear Stub Shaft.....	1	53	Drive Plate Backing Ring.....	1
16	Stub Shaft Lock Ball .....	1	54	Drive Plate Mounting Screw.....	10
17	Piston Ring Expander Spring .....	1	55	Drive Plate Mounting Screw Lockwasher .....	10
18	Piston Ring.....	1	56	Impeller to Cover Screw .....	24
19	Stator Support .....	1	57	Impeller to Cover Screw Lockwasher.....	24
20	Bearing Snap Ring.....	1	58	Turbine Hub .....	1
21	Piston Ring.....	1	59	Turbine .....	1
22	Bearing Retaining Ring .....	1	60	Turbine Hub Ring.....	1
23	Bearing Locating Washer .....	1	61	Turbine to Hub Screw .....	12
24	Turbine Shaft Bearing .....	1	62	Turbine Retaining Ring .....	1
25	Turbine Shaft .....	1	63	Reaction Member Retaining Ring .....	1
26	Baffle Ring .....	1	64	Reaction Member.....	1
27	Stator Support Screw .....	6	65	Impeller to Hub Bearing Spacer.....	1
28	Auxiliary Pump Drive Bearing Support.....	1	66	Impeller to Hub Screw .....	8
29	Bearing Retaining Ring .....	1	67	Impeller to Hub Screw Lock Tab .....	4
30	Pump Drive Gear Bearing .....	1	68	Impeller.....	1
31	Bearing Locating Ring.....	1	69	Impeller Hub "O" Ring .....	1
32	Auxiliary Pump Drive Gear.....	1	70	Impeller Hub Gear .....	1
33	Pump Mounting Cover Gasket .....	1	71	Impeller Hub Gear Bearing .....	1
34	Pump Mounting Cover.....	1	72	Idler Shaft "O" Ring .....	2
35	Pump Mounting Cover Capscrew Lockwasher....	4	73	Reverse Idler Shaft .....	2
36	Pump Mounting Cover Capscrew.....	4	74	Oil Baffle Retaining Ring.....	1
37	Idler Shaft Lockball .....	2	75	Oil Baffle.....	1
38	Reverse Idler Gear Bearing Thrust Plate .....	2	76	Oil Seal .....	1
			77	Oil Baffle Seal Ring.....	1

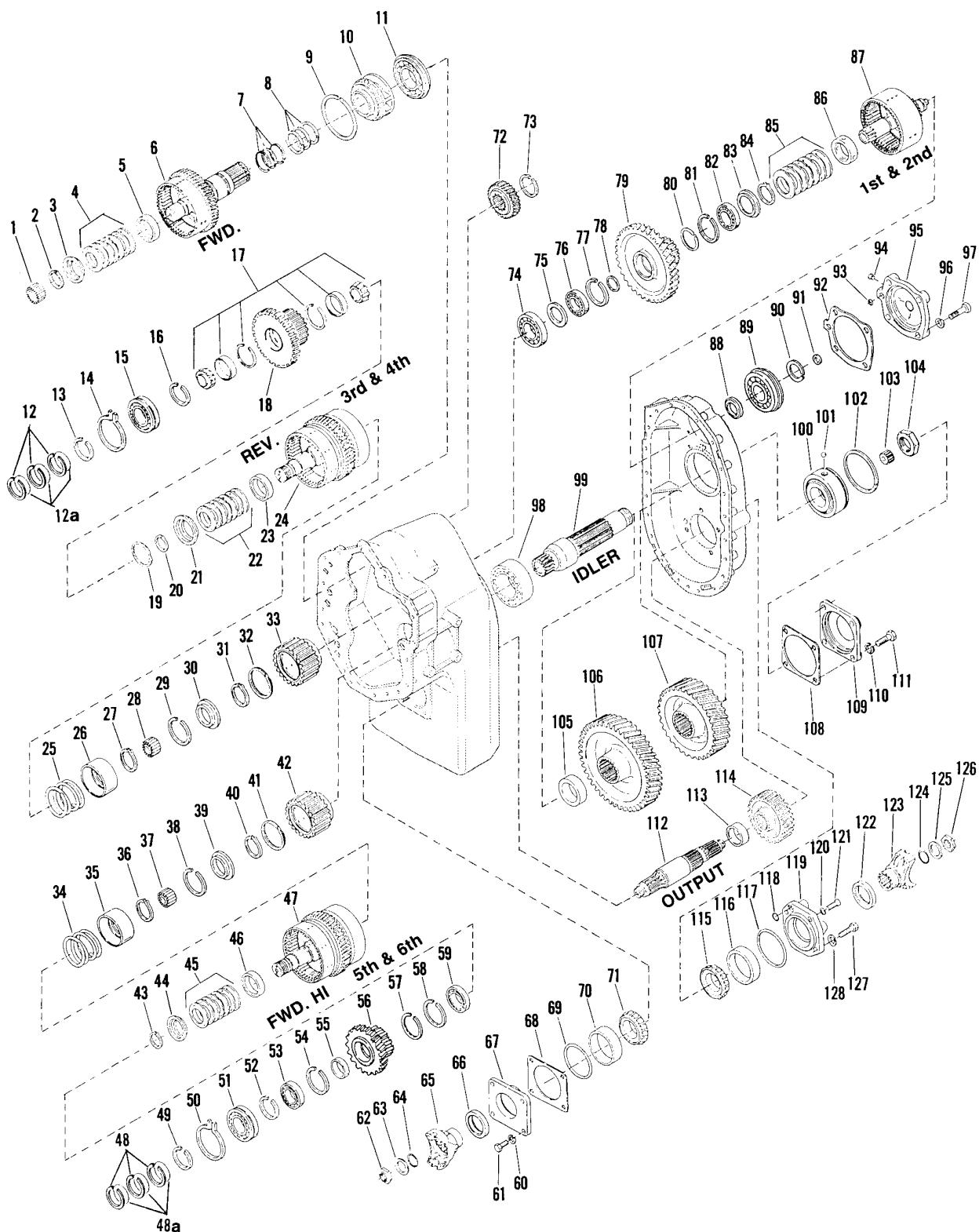


FIGURE D

## CLUTCH AND GEAR GROUP

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Forward Shaft Pilot Bearing	1	64	Flange "O" Ring	1
2	Spring Retainer Ring	1	65	Front Output Flange	1
3	Spring Retainer	1	66	Front Bearing Cap Oil Seal	1
4	Piston Return Spring	7	67	Front Bearing Cap	1
5	Piston Return Spring Spacer	1	68	Bearing Cap Shim	1
6	Forward Shaft, Drum & Plug Assembly	1	69	Front Bearing Cap "O" Ring	AR
7	Piston Ring Expander Spring	3	70	Front Bearing Cup	1
8	Forward Shaft Piston Ring	3	71	Front Bearing Cone	1
9	Piston Ring Sleeve Retaining Ring	1	72	Forward Shaft Gear	1
10	Piston Ring Sleeve	1	73	Gear Retaining Ring	1
11	Forward Shaft Rear Bearing	1	74	1st & 2nd Clutch Shaft Front Bearing	1
12	Reverse Shaft Piston Ring	3	75	Front Bearing Spacer	1
12A	Piston Ring Expander Spring	3	76	1st & 2nd Clutch Gear Bearing	1
13	Front Bearing Retaining Ring	1	77	Bearing Locating Ring	1
14	Front Bearing Snap Ring	1	78	Bearing Spacer	1
15	Reverse Shaft Front Bearing	1	79	1st & 2nd Clutch Gear	1
16	Front Bearing Retaining Ring	1	80	Baffle Ring	1
17	Clutch Driven Gear Bearing Assembly	1	81	Bearing Locating Ring	1
18	Reverse Clutch Gear & Hub Assembly	1	82	1st & 2nd Clutch Bearing	1
19	Baffle Ring	1	83	Belleville Washer Retainer	1
20	Spring Retaining Snap Ring	1	84	Spring Retainer Ring	1
21	Spring Retainer	1	85	Belleville Washer	7
22	Piston Return Spring - Belleville Washer	7	86	Belleville Washer Spacer	1
23	Piston Return Spring Spacer	1	87	1st & 2nd Clutch Drum & Bleed Valve Assembly	1
24	Reverse and 3rd & 4th Clutch Drum and Plug Assembly	1	88	Bearing to Shaft Spacer	1
25	Piston Return Spring	1	89	Clutch Shaft Rear Bearing	1
26	Spring Retainer	1	90	Bearing Retainer Ring	1
27	Spring Retainer Snap Ring	1	91	1st & 2nd Shaft Piston Ring	1
28	3rd & 4th Clutch Shaft Pilot Bearing	1	92	Bearing Cap Gasket	1
29	Retainer Locating Ring	1	93	Bearing Cap "O" Ring	1
30	Retaining Ring Retainer	1	94	Bearing Cap Plug	1
31	Clutch Disc Hub Retaining Ring	1	95	Rear Bearing Cap	1
32	Baffle Ring	1	96	Bearing Cap Screw Lockwasher	4
33	Clutch Disc Hub	1	97	Bearing Cap Screw	4
34	Piston Return Spring	1	98	Idler Shaft Front Bearing	1
35	Spring Retainer	1	99	Idler Shaft	1
36	Spring Retainer Ring	1	100	Idler Shaft Rear Bearing	1
37	5th & 6th Clutch Shaft Pilot Bearing	1	101	Idler Shaft Rear Bearing Lock Ball	1
38	Retainer Snap Ring	1	102	Rear Bearing Locating Ring	1
39	Retaining Ring Retainer	1	103	Pump Drive Sleeve	1
40	Clutch Disc Hub Retaining Ring	1	104	Idler Shaft Nut	1
41	Baffle Ring	1	105	Idler Gear Spacer	1
42	Clutch Disc Hub	1	106	Idler Shaft Gear	1
43	Spring Retainer Ring	1	107	Idler Shaft Gear	1
44	Spring Retainer	1	108	Idler Shaft Bearing Cap Gasket	1
45	Piston Return Spring - Belleville Washer	7	109	Idler Shaft Bearing Cap	1
46	Piston Return Spring Spacer	1	110	Idler Shaft Bearing Cap Screw Lockwasher	4
47	Forward High and 5th & 6th Clutch Drum & Plug Assembly	1	111	Idler Shaft Bearing Cap Screw	4
48	Forward High Shaft Piston Ring	3	112	Output Shaft	1
48A	Piston Ring Expander Spring	3	113	Output Gear Spacer	1
49	Front Bearing Retaining Ring	1	114	Output Shaft Gear	1
50	Front Bearing Snap Ring	1	115	Rear Bearing Cone	1
51	Forward High Shaft Front Bearing	1	116	Rear Bearing Cup	1
52	Front Bearing Retaining Ring	1	117	Rear Bearing Cap "O" Ring	1
53	Clutch Driven Gear Bearing	1	118	Rear Bearing Cap "O" Ring	1
54	Clutch Gear Bearing Retaining Ring	1	119	Rear Bearing Cap	1
55	Clutch Driven Gear Bearing Spacer	1	120	Rear Bearing Cap Screw Lockwasher	3
56	Forward High Clutch Gear & Hub Assembly	1	121	Rear Bearing Cap Screw	3
57	Oil Baffle Ring	1	122	Rear Bearing Cap Oil Seal	1
58	Clutch Gear Bearing Retaining Ring	1	123	Rear Output Flange	1
59	Clutch Driven Gear Bearing	1	124	Flange "O" Ring	1
60	Front Bearing Cap Screw Lockwasher	4	125	Flange Washer	1
61	Front Bearing Cap Screw	4	126	Flange Nut	1
62	Flange Nut	1	127	Rear Bearing Cap Screw	1
63	Flange Washer	1	128	Rear Bearing Cap Screw Lockwasher	1

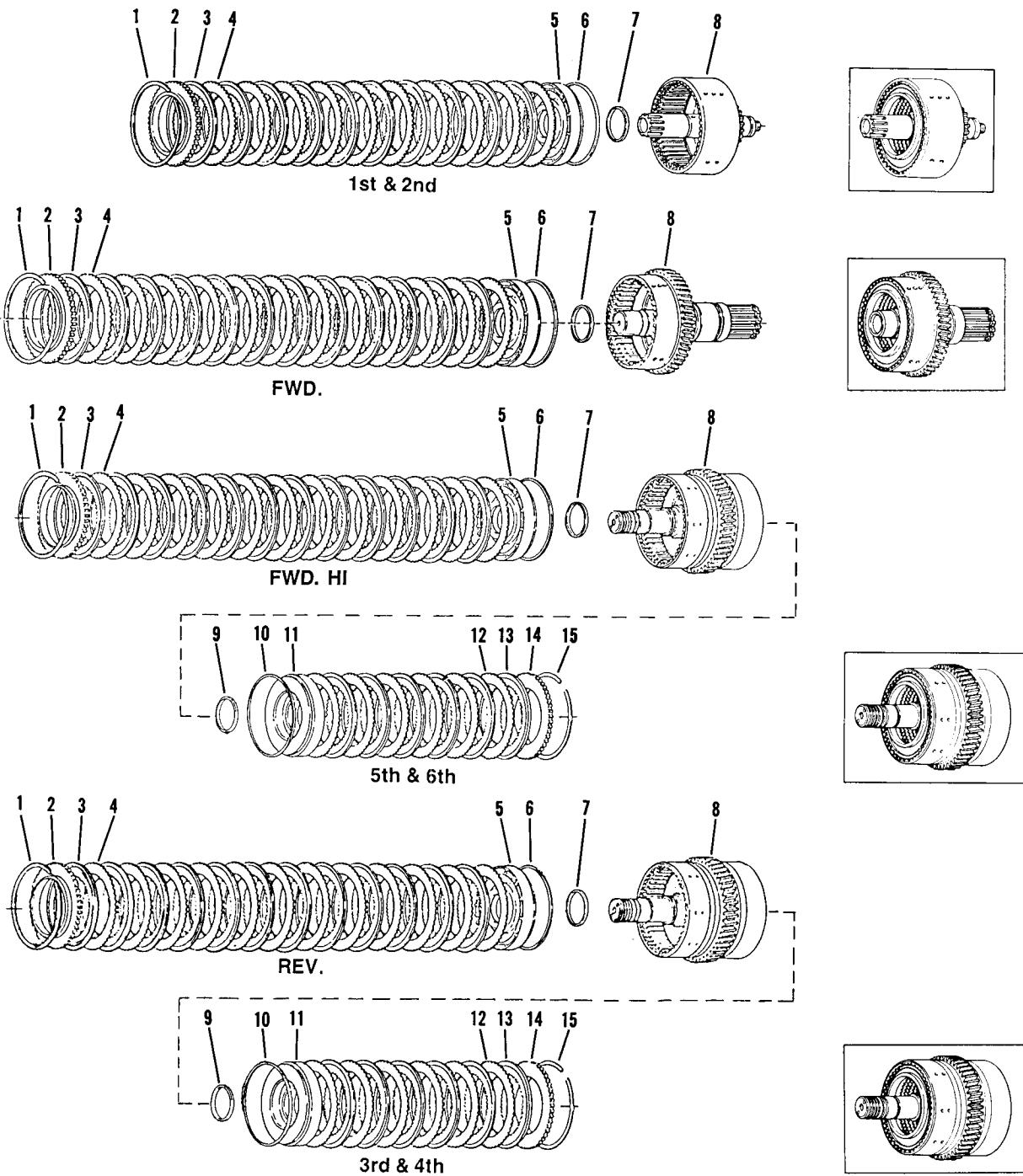


FIGURE E

## CLUTCH ASSEMBLY -1st &amp; 2nd

ITEM DESCRIPTION	QTY.	ITEM DESCRIPTION	QTY.
1 Backing Plate Retaining Ring.....	1	5 Clutch Piston.....	1
2 Clutch Disc Backing Plate.....	1	6 Clutch Piston Seal -Outer.....	1
3 Clutch Inner Disc.....	10	7 Clutch Piston Seal -Inner.....	1
4 ClutchOuterDisc .....	10	8 1st & 2nd Clutch Drum Assembly.....	1

## CLUTCH ASSEMBLY -FORWARD

ITEM DESCRIPTION	QTY.	ITEM DESCRIPTION	QTY.
1 Backing Plate Retaining Ring.....	1	5 Clutch Piston.....	1
2 Clutch Disc Backing Plate.....	1	6 Clutch Piston Seal -Outer.....	1
3 Clutch Inner Disc.....	12	7 Clutch Piston Seal Inner.....	1
4 Clutch Outer Disc.....	12	8 Forward Clutch Drum Assembly.....	1

CLUTCH ASSEMBLY  
FORWARD HIGH & 5th -6th

ITEM DESCRIPTION	QTY.	ITEM DESCRIPTION	QTY.
1 Backing Plate Retaining Ring.....	1	8 Forward High & 5th -6th Clutch Drum Assembly.....	1
2 Clutch Disc Backing Plate.....	1	9 Clutch Piston Seal -Inner.....	1
3 Clutch Inner Disc.....	12	10 Clutch Piston Seal -Outer.....	1
4 Clutch Outer Disc.....	12	11 Clutch Piston -5th & 6th .....	1
5 Clutch Piston-High.....	1	12 Clutch Outer Disc.....	6
6 Clutch Piston Seal -Outer.....	1	13 Clutch Inner Disc.....	6
7 Clutch Piston Seal -Inner.....	1	14 Clutch Disc Backing Plate.....	1
		15 Backing Plate Retaining Ring.....	1

CLUTCH ASSEMBLY  
REVERSE -3rd & 4th

ITEM DESCRIPTION	QTY.	ITEM DESCRIPTION	QTY.
1 Backing Plate Retaining Ring .....	1	8 Reverse & 3rd -4th Clutch Drum Assembly.....	1
2 Clutch Disc Backing Plate.....	1	9 Clutch Piston Seal-Inner.....	1
3 Clutch Inner Disc.....	12	10 Clutch Piston Seal -Outer.....	1
4 Clutch Outer Disc.....	12	11 ClutchPiston-3rd&4th .....	1
5 Clutch Piston -Reverse.....	1	12 ClutchOuterDisc .....	6
6 Clutch Piston Seal -Outer.....	1	13 ClutchInnerDisc .....	6
7 Clutch Piston Seal-Inner.....	1	14 Clutch Disc Backing Plate.....	1
		15 Backing Plate Retaining Ring.....	1

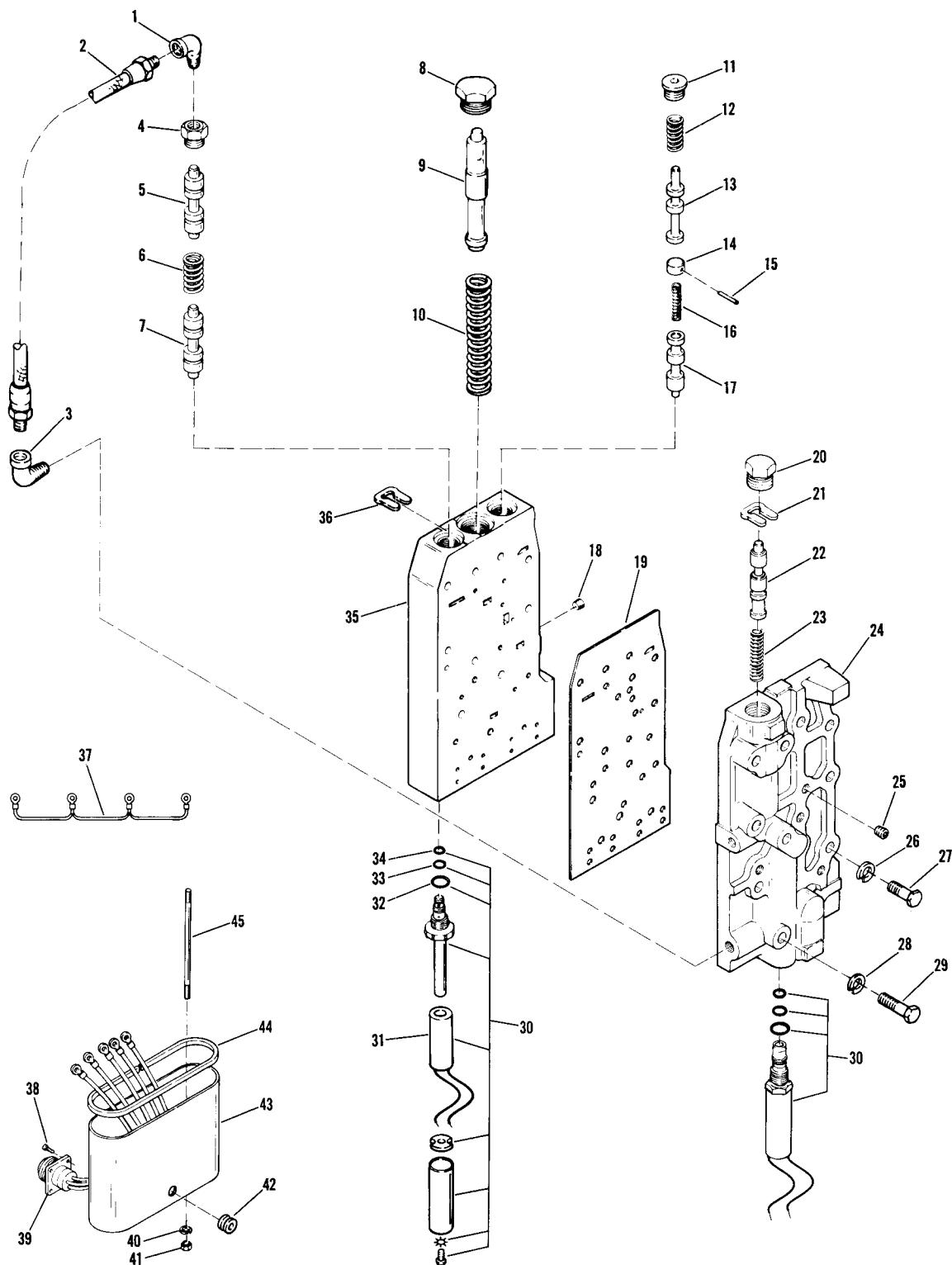


FIGURE F

**ELECTRIC CONTROL VALVE ASSEMBLY**  
**(6 SPEED FULL POWER SHIFT)**  
**(LESS DECLUTCH)**

ITEM	DESCRIPTION	QTY.
1	Elbow.....	1
2	Forward Pressure Tube Assembly.....	1
3	Elbow.....	1
4	Valve Plug.....	1
5	Forward & Reverse Shift Spool.....	1
6	Spool Position Spring .....	1
7	Forward & Reverse Shift Spool.....	1
8	Valve Housing Plug .....	1
9	Valve Spool.....	1
10	Control Valve Spring .....	1
11	Valve Housing Spool Bore Plug .....	1
12	Spool Position Spring .....	1
13	Shift Spool .....	1
14	Spool Stop .....	1
15	Roll Pin .....	1
16	Spring .....	1
17	1st Speed Shift Spool .....	1
18	Pipe Plug.....	2
19	Shuttle Valve to Electric Control Gasket .....	1
20	Port Plug .....	1
21	Spool Stop .....	1
22	High-Low Shuttle Spool.....	1
23	Shuttle Spool Spring .....	1
24	Shuttle Valve Body.....	1
25	Pipe Plug.....	7
26	Valve Mounting Screw Lockwasher .....	2
27	Valve Mounting Screw .....	2
28	Valve Mounting Screw Lockwasher .....	1
29	Valve Mounting Screw.....	1
30	Soleniod .....	5
31	Solenoid Coil .....	5
32	Solenoid "O" Ring .....	5
33	Solenoid "O" Ring .....	5
34	Solenoid "O" Ring .....	5
35	Control Valve Housing .....	1
36	Valve Spool Stop .....	1
37	Ground Wire Harness.....	1
38	Receptacle Mounting Screw .....	4
39	Receptacle & Wire Assembly .....	1
40	Dust Cover Mounting Stud Lockwasher.....	2
41	Dust Cover Mounting Stud Nut.....	2
42	Grommet .....	1
43	Dust Cover .....	1
44	Dust Cover Seal .....	1
45	Dust Cover Mounting Stud .....	2

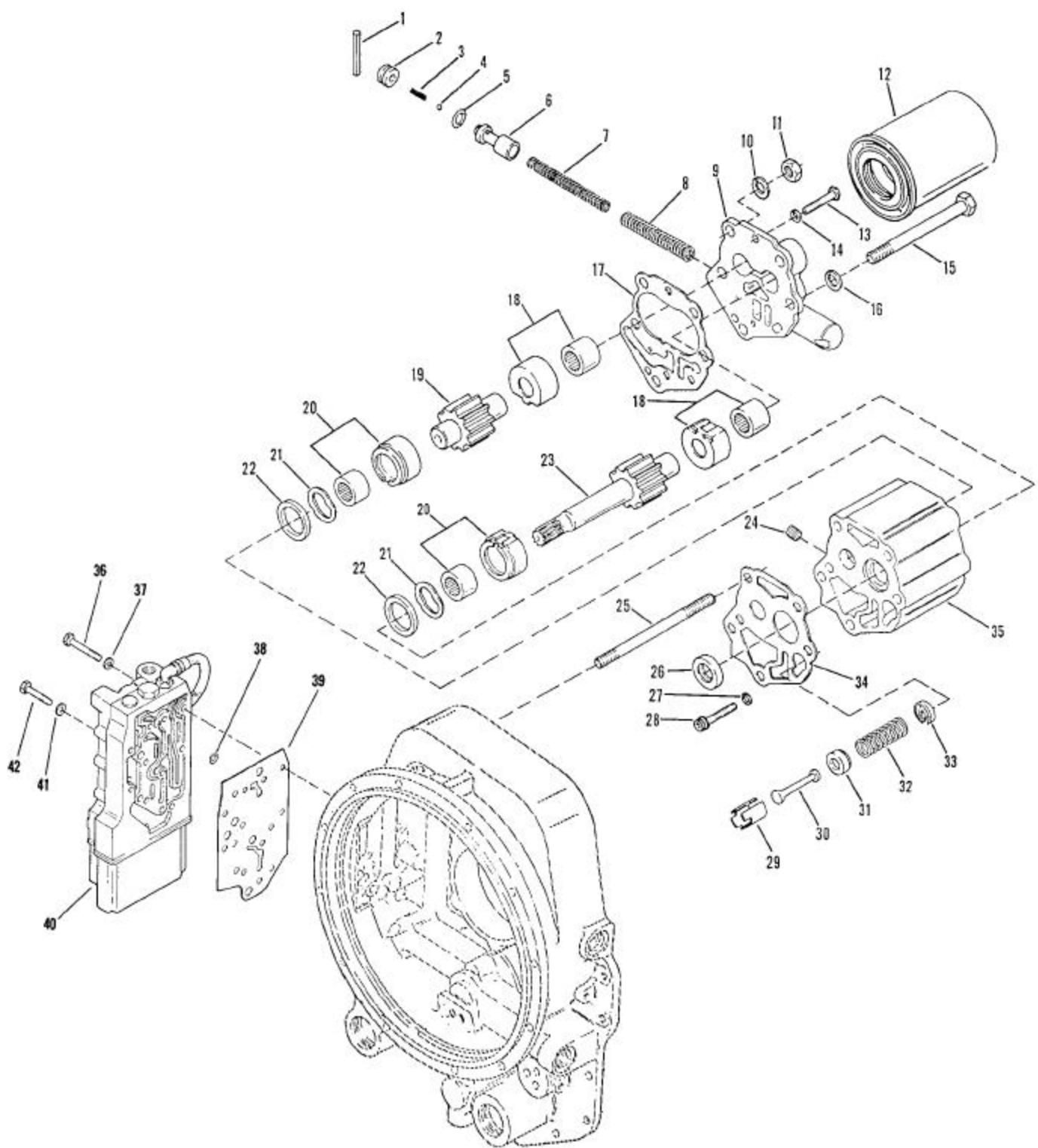


FIGURE G

**CHARGING PUMP & VALVE  
ASSEMBLY GROUP**

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Valve Stop Roll Pin .....	1	22	Thrust Plate Seal .....	2
2	Valve Stop.....	1	23	Pump Drive Shaft Assembly .....	1
3	Spring .....	1	24	Pipe Plug.....	1
4	Ball.....	1	25	Pump Mounting Stud.....	2
5	Valve Stop "O" Ring .....	1	26	Pump Drive Gear Oil Seal .....	1
6	Valve Piston .....	1	27	Pump Mounting Screw Lockwasher....	3
7	Valve Spring - Inner.....	1	28	Pump Mounting Screw .....	3
8	Valve Spring - Outer .....	1	29	Safety Valve Spacer.....	1
9	Regulating Valve & Filter Adaptor Assembly.....	1	30	Safety Valve Poppet.....	1
10	Pump Mounting Stud Lockwasher .....	2	31	Safety Valve Seat.....	1
11	Pump Mounting Stud Nut .....	2	32	Safety Valve Spring .....	1
12	Filter Assembly.....	1	33	Safety Valve Retainer.....	1
13	Valve to Pump Capscrew.....	2	34	Pump Assembly to Converter Housing Gasket.....	1
14	Valve to Pump Capscrew Lockwasher ...	2	35	Pump Body .....	1
15	Valve to Pump Capscrew.....	1	36	Valve Mounting Screw.....	4
16	Valve to Pump Screw Lockwasher.....	1	37	Valve Mounting Screw Lockwasher....	4
17	Valve to Pump Gasket.....	1	38	High Clutch Pressure "O" Ring.....	1
18	Thrust Plate & Bearing Assembly.....	2	39	Valve to Converter Housing Gasket .....	1
19	Pump Driven Shaft Assembly .....	1	40	Control Valve Assembly.....	1
20	Thrust Plate & Bearing Assembly.....	2	41	Valve Mounting Screw Lockwasher....	5
21	Wave Spring.....	2	42	Valve Mounting Screw.....	5

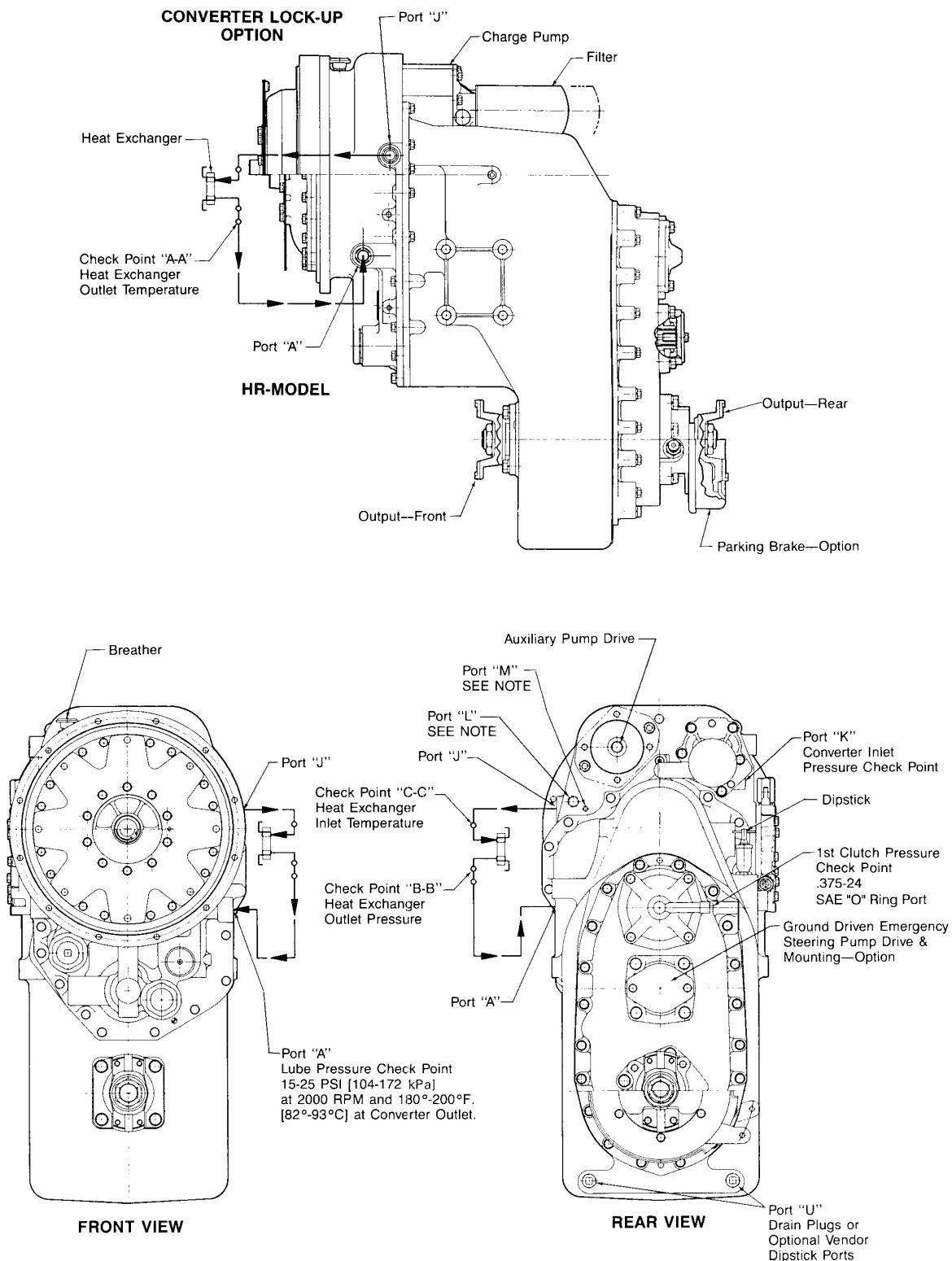
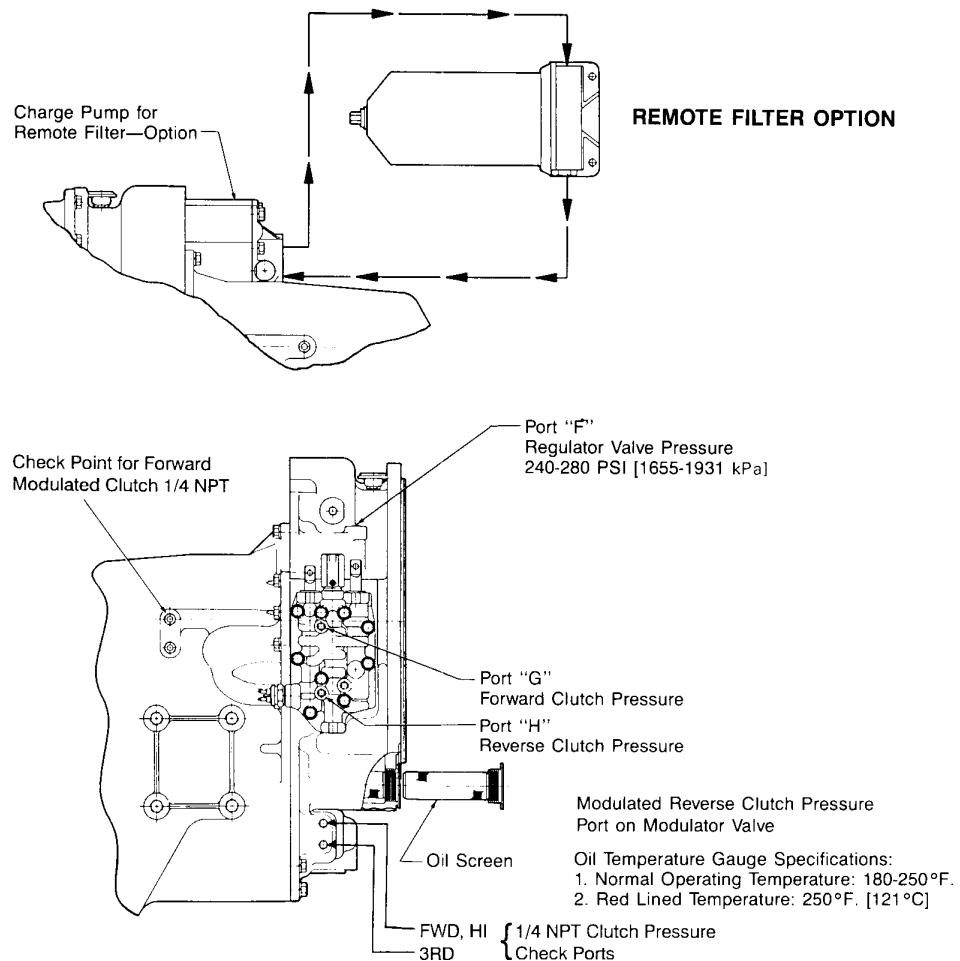


FIGURE H



## Notes

## Hose Line Operating Requirements

1 Pressure Lines-Suitable for operation from ambient to 250°F [121°C] continuous operating temperature. Must withstand 300 PSI [2068 kPa] continuous pressure, with 600 PSI [4137 kPa] intermittent surges Ref SAE Spec No J517, 100R1 Hydraulic Hose Specifications.

2 See Lubrication Specifications

3 All hose lines used must conform to SAE Spec No J 1019 Tests and Procedures for High Temperature Transmission Oil Hose.

## Port "L"-Converter Outlet Temperature

Port is to be used for Converter Outlet Temperature pick-up Gauge is to be located in the Operator Compartment See Oil Temperature Gauge Specifications

## Port "M"-Converter Outlet Pressure

Pressure must be measured during normal vehicle "Production Line" test Converter outlet pressure equals the total pressure drop of the Heat Exchanger, Heat Exchanger Lines and back pressure of the transmission lubrication system.

## Test Conditions

1 Converter Outlet Oil Temperature 180-220°F. [82-104°C]  
2 Transmission in Neutral

## Operating Specifications.

1 25 PSI [173 kPa] Min pressure at 2000 RPM engine speed and a max of 70 PSI [483 kPa] outlet pressure at a no-load governed speed

Ports "B", "F", "K", "L" and "M"  
These ports can be used for field "Trouble Shooting" or vehicle "Production Line" tests

## Ports "F", "L" and "M"

These ports are to be used as check points for normal vehicle "Production Line" test

## Port "F"-Clutch Pressure

It is recommended that clutch pressure be monitored by a gauge having an indicator dial range of 0 to 400 PSI [0 to 2758 kPa] and located in the Operator Compartment

Ports "G" and "H"-Back-up Warning These ports are provided for installation of Back-up Pressure Switch for Warning Light or Horn

FIGURE H

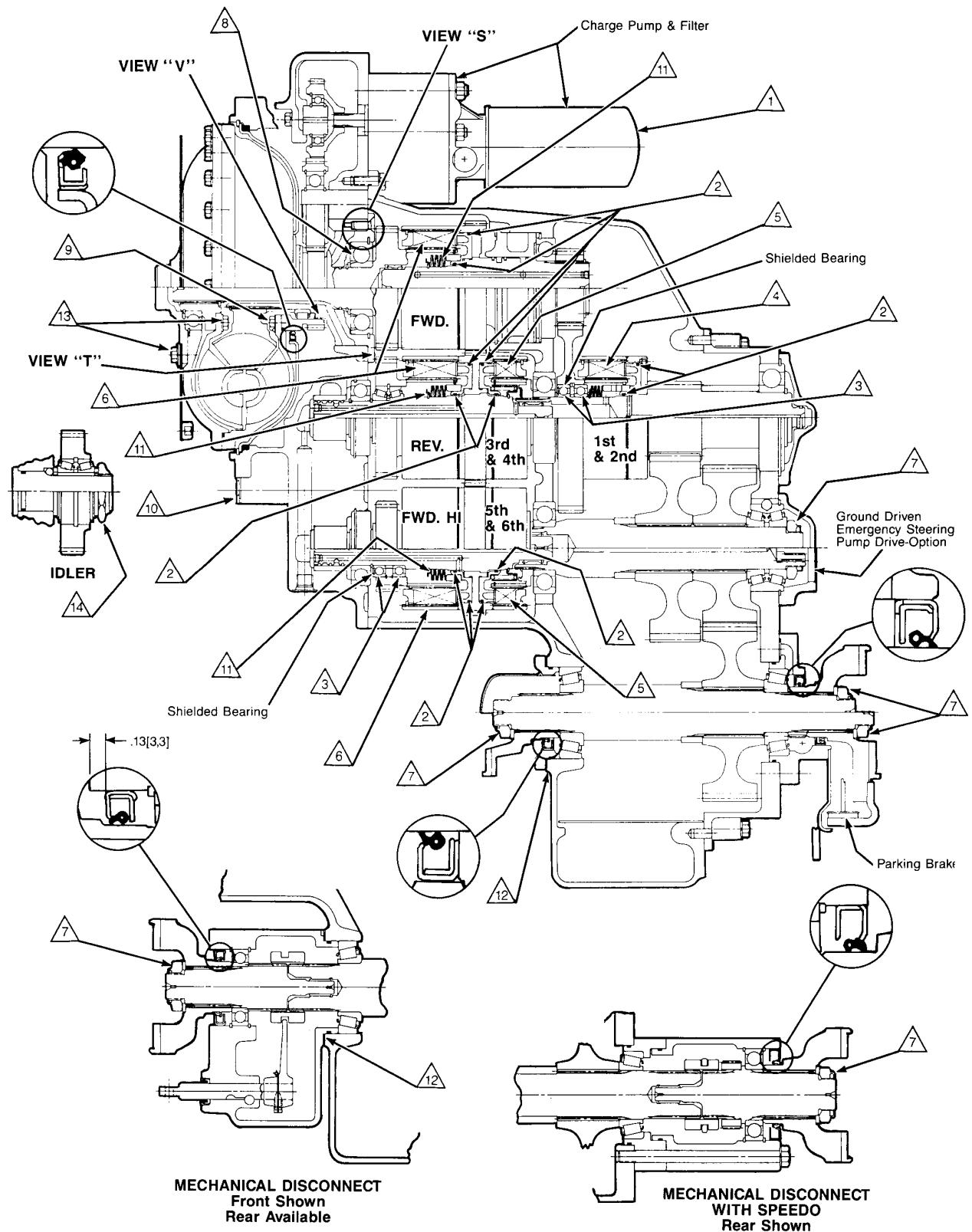


FIGURE I

**1** Assemble oil filter and tighten 20 to 25 Lbs.Ft. [27,2-33,8 N·m]

**2** Teflon seals must be sized prior to ass'y.

**3** Must be loose internal fit bearing with a No. 3 etched on the bearing.

**4** 10-outer steel plates, 10-inner friction plates. Alternately assemble, starting with outer steel plate.

**5** 6-outer steel plates, 6-inner friction plates. Alternately assemble, starting with outer steel plate.

**6** 12-outer steel plates, 12-inner friction plates. Alternately assemble, starting with outer steel plate.

**7** Tighten 200 to 250 Lbs.Ft [271,2-338,9 N·m]

**8** Special bearing loading notches opposite snap ring.

**9** Bend lock tabs after tightening cap screws to proper torque.

**10** Tighten oil screen assy 10 to 15 Lbs.Ft. [13,6-20,3 N·m]

**11** Low, Forward and Reverse Clutch Springs- Concave side of first disc spring to be placed against clutch piston. Remaining six springs of each clutch to be stacked alternately reversed as shown.



**12** Shim output shaft bearings to produce 6 to 8 Lbs. in. [0,68-0,90 N·m] pre load.

**13** Clean mounting surfaces and tapped holes with solvent. Dry thoroughly, being certain tapped holes are dry and clean. **See text for proper installation.**

**14** Tighten 200-250 Lbs. Ft. [271,2-338,9 N·m] and stake nut securely into shaft notch.

**15** Stator support screw assembly: (View "S")  
1. Clean stator support mounting surface and tapped holes with solvent. Dry thoroughly, being certain tapped holes are clean and dry.  
2. Install 6 special stator support screws. Tighten screws 12 to 16 Lbs. Ft. [16,3-21,6 N·m] torque. **See Caution.**

## NOTES

All lead in chamfers for oil seals, piston rings, and "O" rings must be smooth and free from burrs. Inspect at assembly

Lubricate all piston ring grooves and "O" rings with oil before assembly.

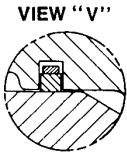
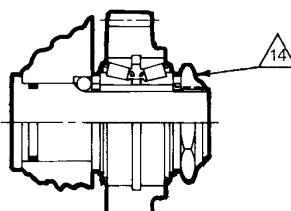
Apply a thin coating of grease between seal lips on lip type seals prior to assembly.

Apply a very light coat of Permatex No.2 to O-D. of all oil seals and bore plugs before as!

Apply a light coat of Loctite No.592 to all uncoated plugs.

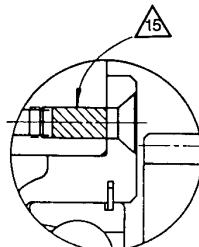
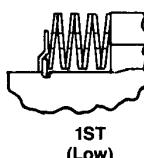
Apply a light coat of Permatex No.2 to all thru hole stud threads.

After assembly of parts using Loctite or Permatex, there must not be any free or excess material which might enter the oil circuit.



Enlarged view of stator support piston ring & expander

Note: Expander gap to be approx. 180° from ring hook joint to aid assembly.



## Caution:

Assembly of stator support to converter housing must be completed within a 15 minute period from start of screw installation. The special screw is to be used for one installation only. If screw is removed for any reason, it must be replaced. The Loctite left in the holes must be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a new screw for reinstallation.

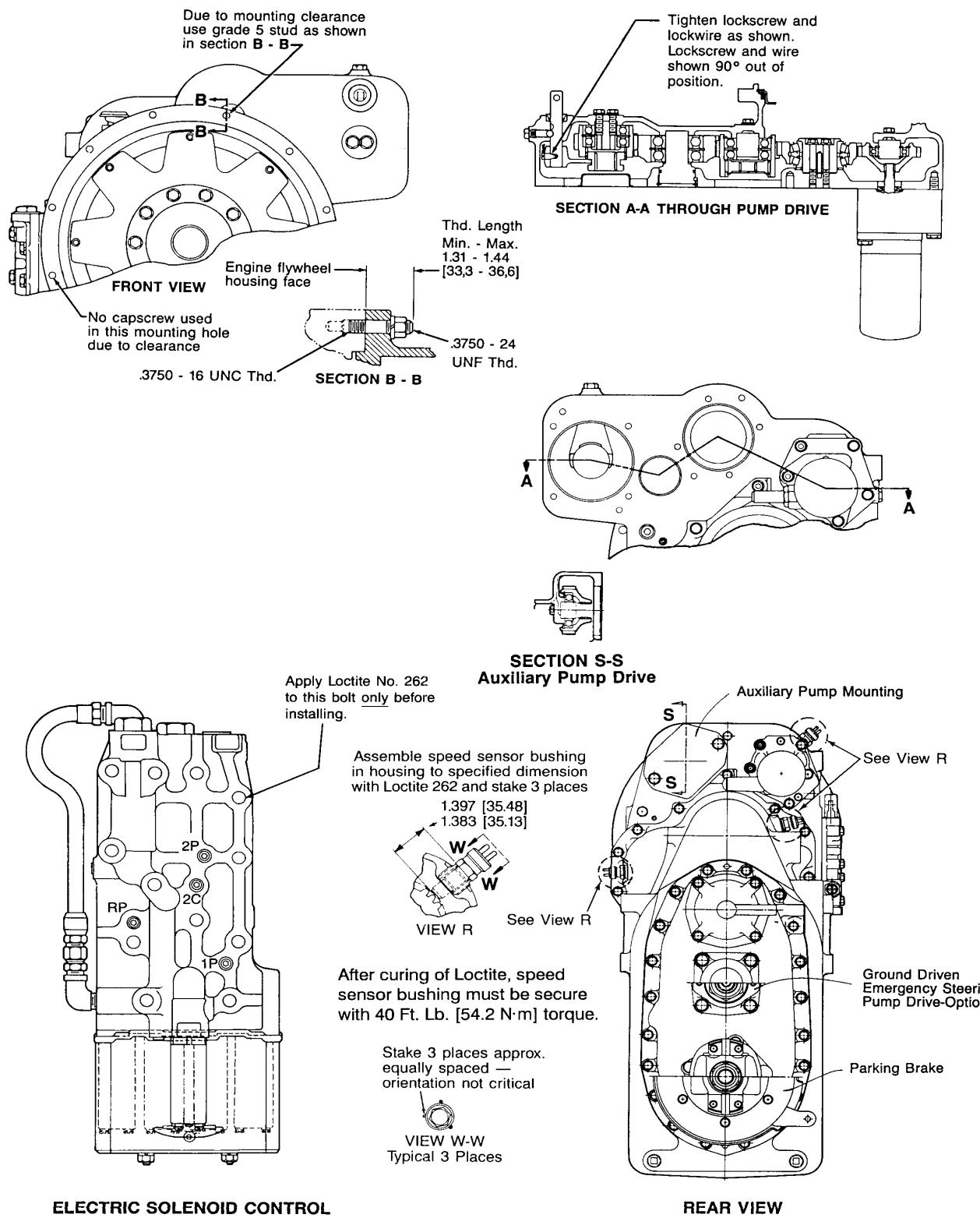
## Grade 5

## Torque Specification for Lubricated or Plated Screw Threads

## Grade 8

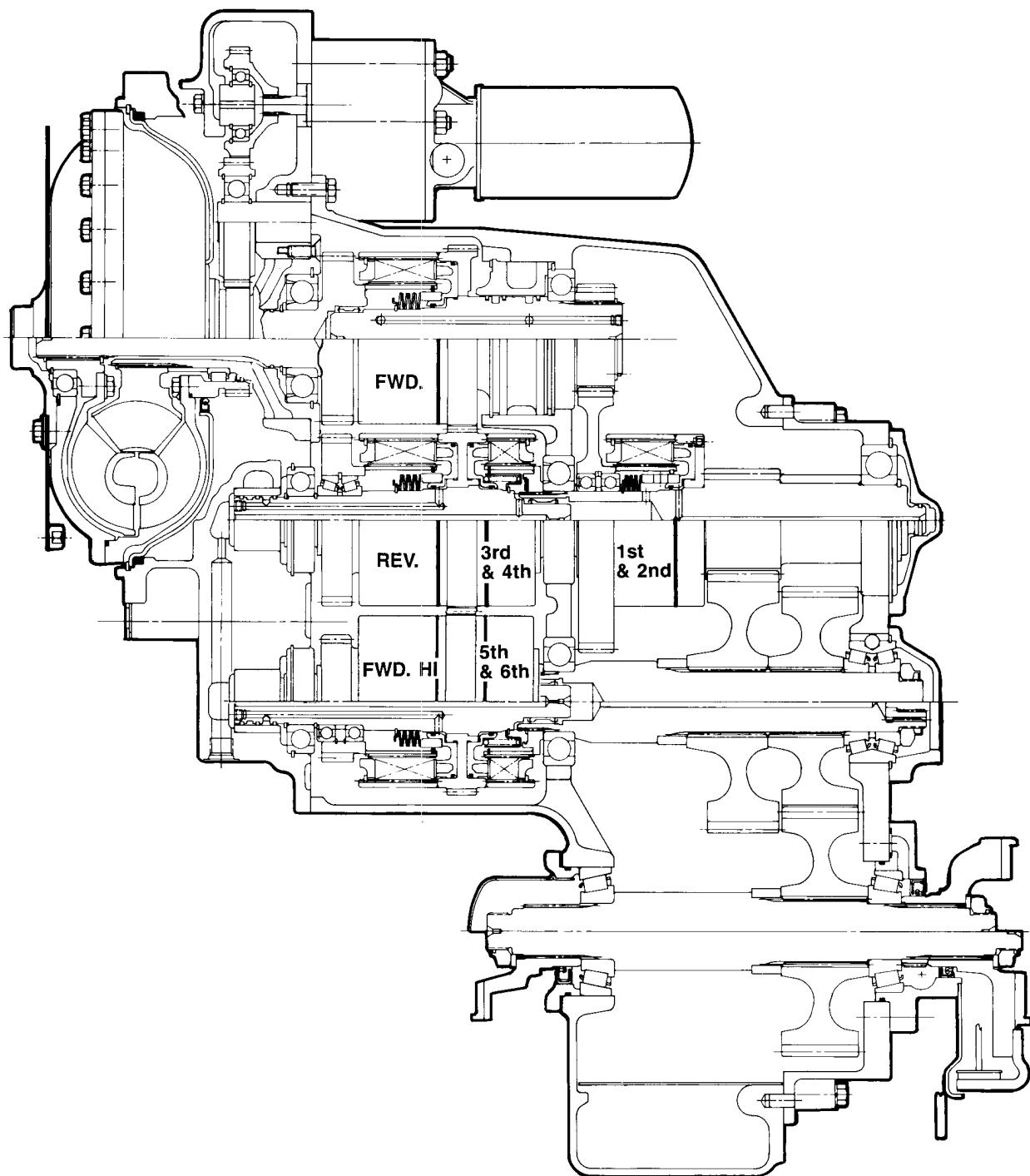
NOM. SIZE	FINE THREAD		COARSE THREAD		NOM. SIZE	FINE THREAD		COARSE THREAD	
	LB-FT	[ N·m ]	LB-FT	[ N·m ]		LB-FT	[ N·m ]	LB-FT	[ N·m ]
.2500	9 - 11	[ 12,3 - 14,9 ]	8 - 10	[ 10,9 - 13,5 ]	11 - 13	[ 15,0 - 17,6 ]	9 - 11	[ 12,3 - 14,9 ]	
.3125	16 - 20	[ 21,7 - 27,1 ]	12 - 16	[ 16,3 - 21,6 ]	28 - 32	[ 38,0 - 43,3 ]	26 - 30	[ 35,3 - 40,6 ]	
.3750	26 - 29	[ 35,3 - 39,3 ]	23 - 25	[ 31,2 - 33,8 ]	37 - 41	[ 50,2 - 55,5 ]	33 - 36	[ 44,8 - 48,8 ]	
.4375	41 - 45	[ 55,6 - 61,0 ]	37 - 41	[ 50,2 - 55,5 ]	58 - 64	[ 78,7 - 86,7 ]	52 - 57	[ 70,6 - 77,2 ]	
.5000	64 - 70	[ 86,8 - 94,9 ]	57 - 63	[ 77,3 - 85,4 ]	90 - 99	[ 122,1 - 134,2 ]	80 - 88	[ 108,5 - 119,3 ]	
.5625	91 - 100	[ 123,4 - 135,5 ]	82 - 90	[ 111,2 - 122,0 ]	128 - 141	[ 173,6 - 191,1 ]	115 - 127	[ 156,0 - 172,2 ]	
.6250	128 - 141	[ 173,5 - 191,2 ]	113 - 124	[ 153,2 - 168,1 ]	180 - 198	[ 224,0 - 268,5 ]	159 - 175	[ 215,6 - 237,3 ]	
.7500	223 - 245	[ 302,3 - 332,2 ]	200 - 220	[ 271,2 - 298,3 ]	315 - 347	[ 427,1 - 470,5 ]	282 - 310	[ 382,3 - 420,3 ]	

FIGURE I



ELECTRIC SOLENOID CONTROL

FIGURE I



HR 24000 -6 SPEED TRANSMISSION

TYPICAL CROSS SECTION

FIGURE J

## MAINTENANCE AND SERVICE

The instructions contained herein cover the disassembly and reassembly of the transmission in a sequence that would normally be followed after the unit has been removed from the machine and is to be completely overhauled. It must be understood that this is a basic HR24000 6 speed full power shift transmission with many options. All HR24000 6 speed full power shift transmissions are very similar to trouble shoot, disassemble, repair and reassemble.

**CAUTION:** Cleanliness is of extreme importance and an absolute must in the repair and overhaul of this unit. Before attempting any repairs, the exterior of the unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism. Drain unit thoroughly before disassembly.

## DISASSEMBLY

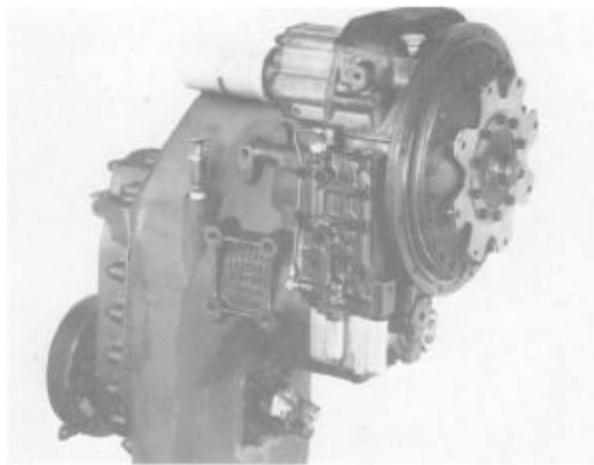


Figure 1

Side view HR24000 6 speed full power shift transmission.  
(Electric Control Valve)

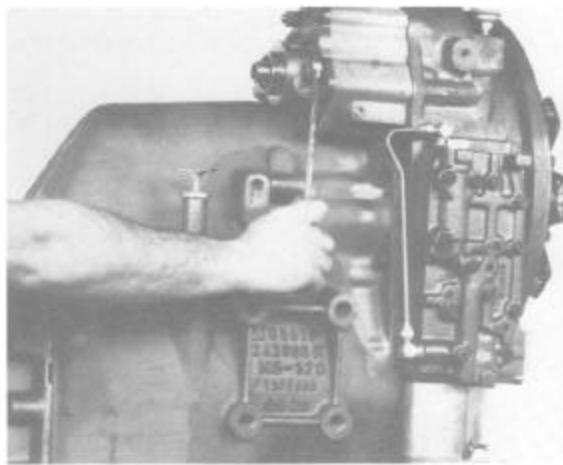


Figure 3

Remove pressure regulating valve stud nuts, bolts and washers.

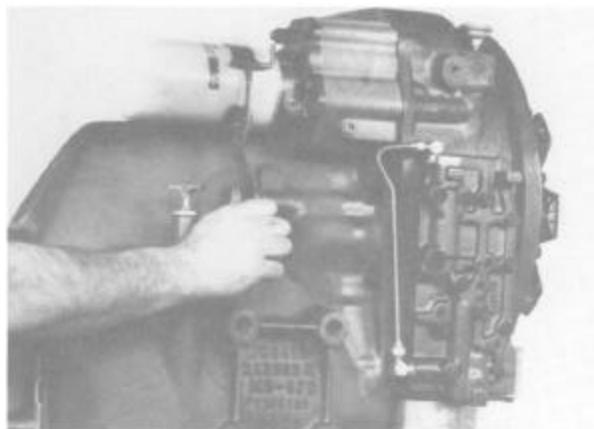


Figure 2

Loosen filter assembly. It is recommended a small pan be used to catch the oil left in the filter element. Remove filter element.

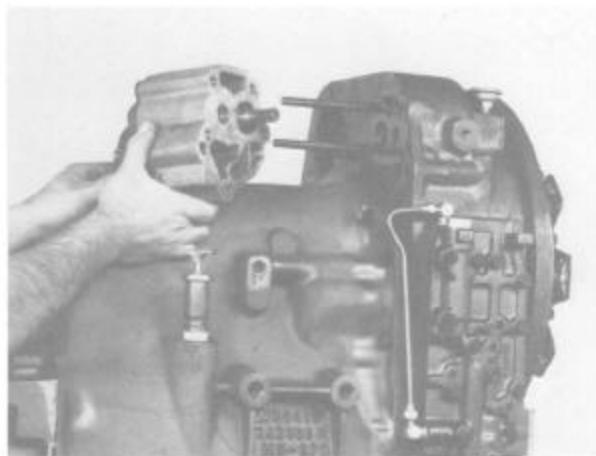


Figure 4

Remove pressure regulating valve and charging pump assembly.

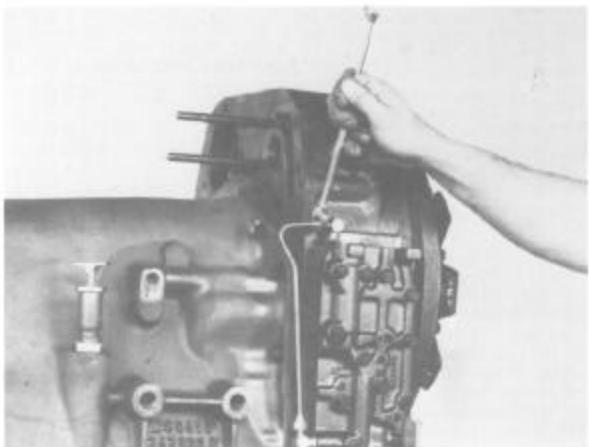


Figure 5

Disconnect shuttle valve to control valve cross over tube.

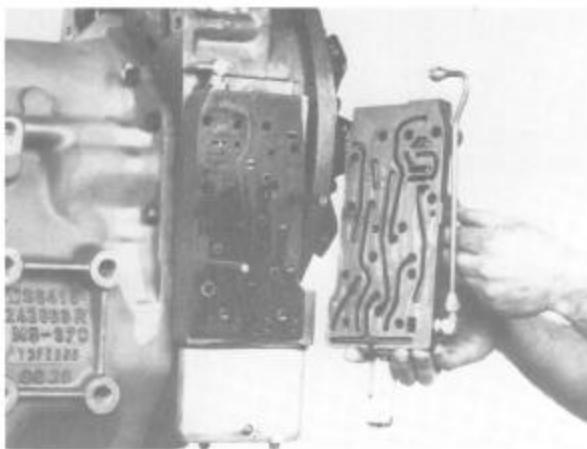


Figure 8

Remove shuttle valve assembly from aligning studs.

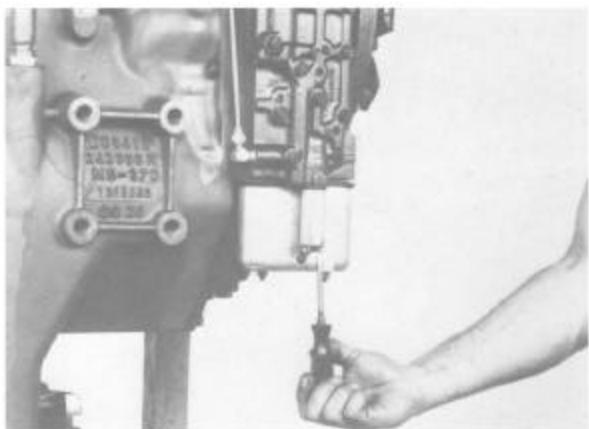


Figure 6

Disconnect shuttle valve solenoid wires.

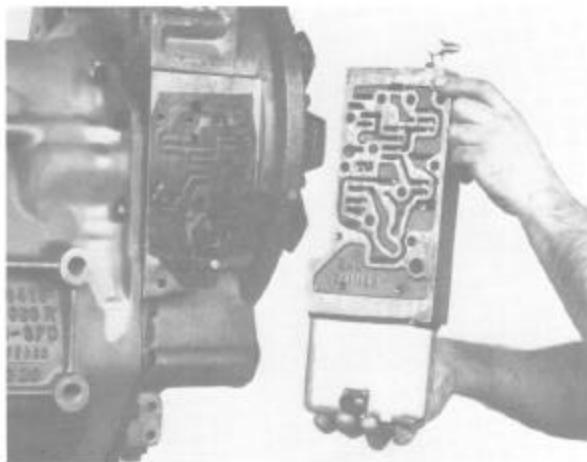


Figure 9

Remove control valve assembly.

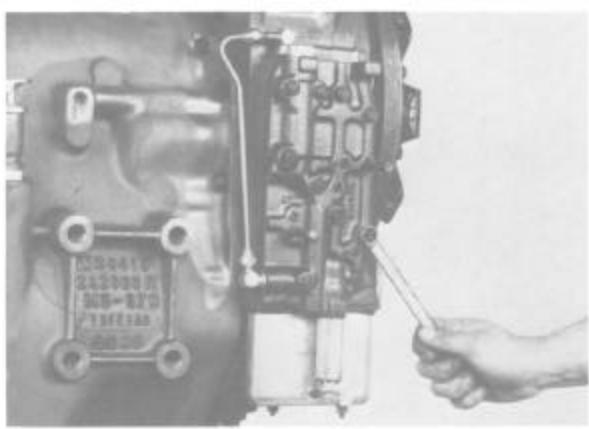


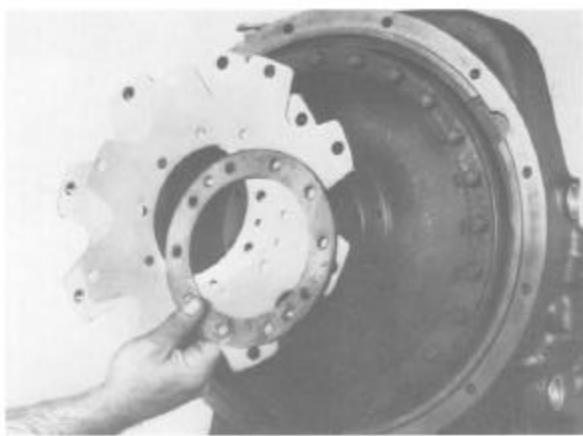
Figure 7

Remove two valve to converter housing cap screws. Install two aligning studs to facilitate valve removal. Remove remaining cap screws.

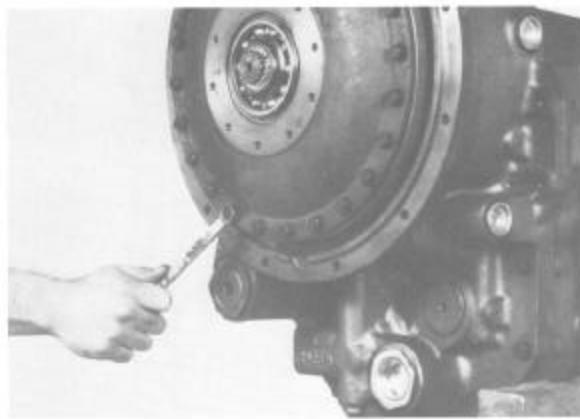


Figure 10

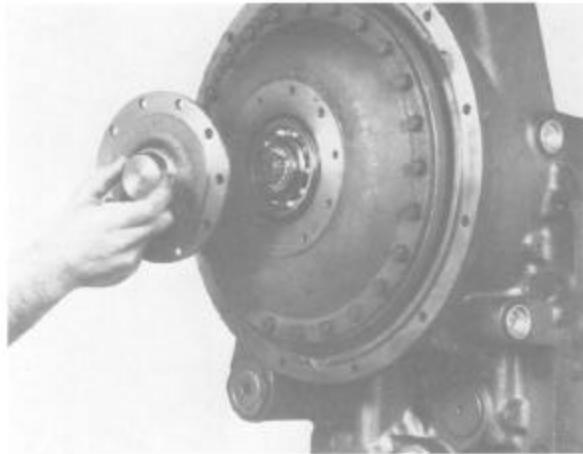
Remove drive plate cap screws and washers. Some units will have stud nuts and washers.

**Figure 11**

Remove drive plate and backing ring.

**Figure 14**

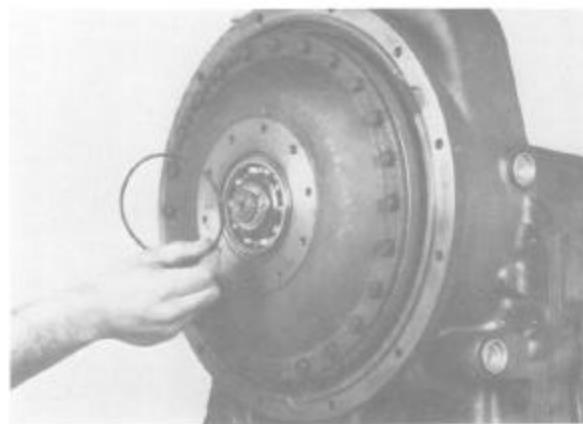
Remove impeller cover bolts. **NOTE:** It is recommended a container be available to catch remaining oil in wheel section.

**Figure 12**

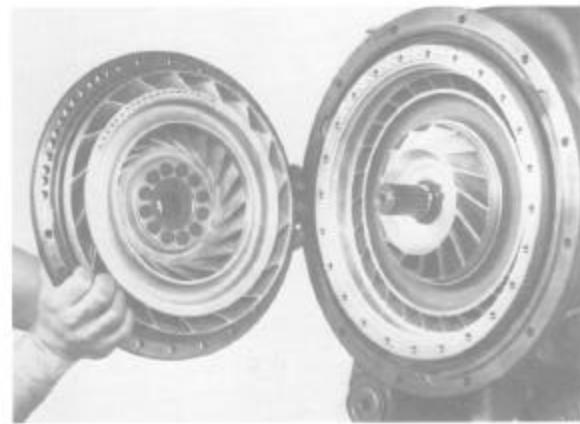
Remove impeller cover bearing cap.

**Figure 15**

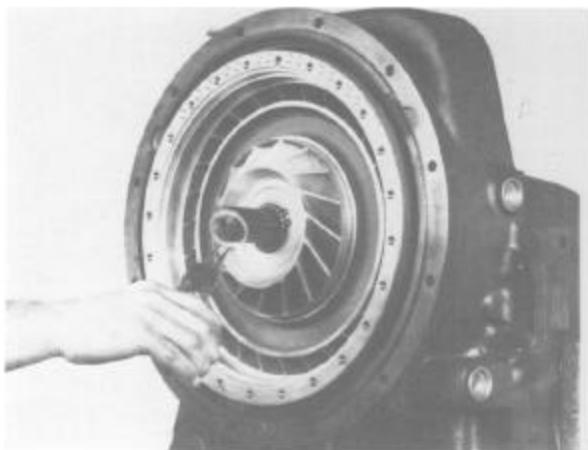
Remove turbine hub to turbine shaft retaining ring.

**Figure 13**

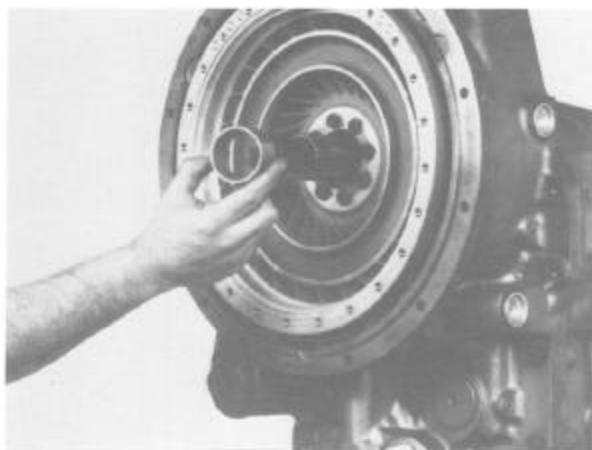
Remove bearing cap "O" ring.

**Figure 16**

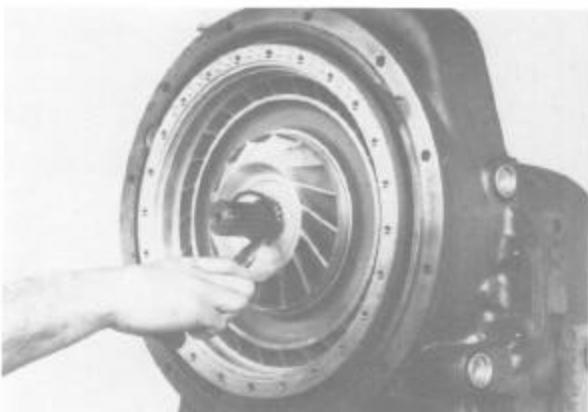
Remove impeller cover and turbine as an assembly.

**Figure 17**

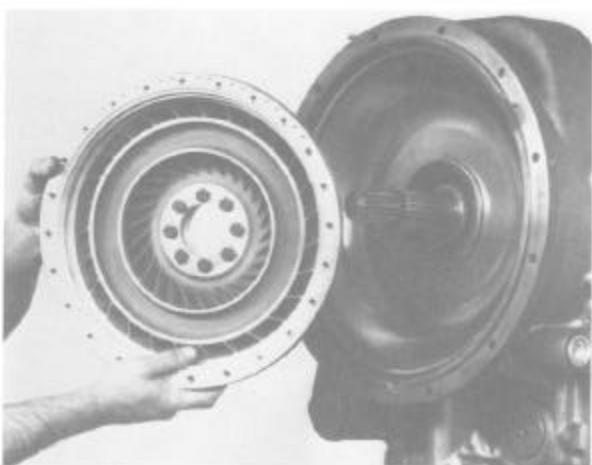
Remove turbine to turbine shaft locating ring.

**Figure 20**

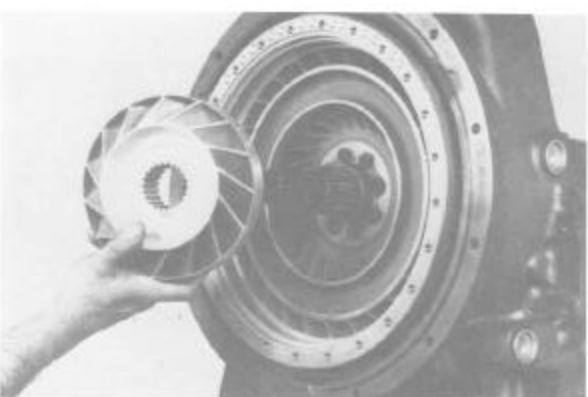
Remove reaction member spacer.

**Figure 18**

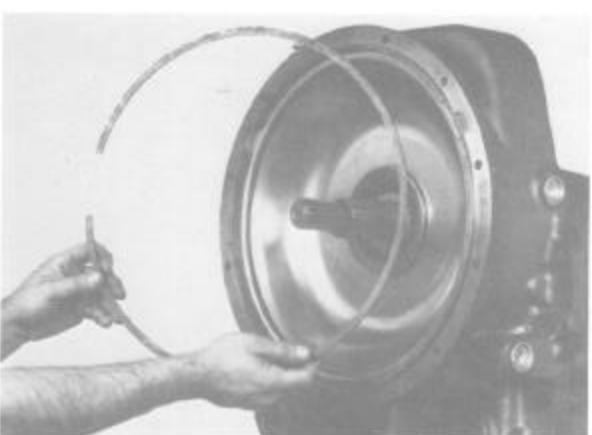
Remove reaction member retaining ring.

**Figure 21**

Remove impeller.

**Figure 19**

Remove reaction member. **NOTE:** Some units will have a fixed reaction member and some units will have a free-wheeling reaction member. The fixed is a one piece and the freewheeling is an assembly. Remove as an assembly.

**Figure 22**

Remove oil baffle retaining ring.

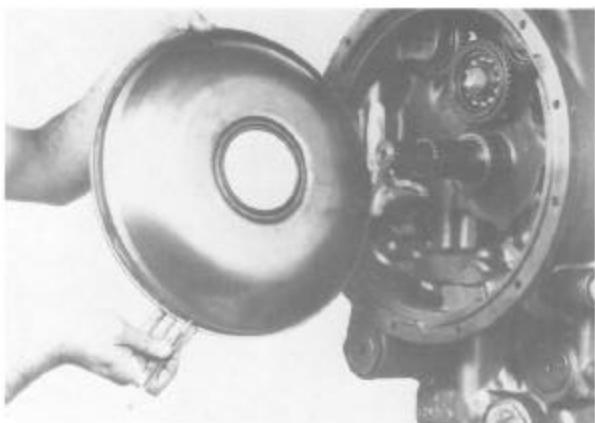


Figure 23

Pry oil baffle from housing. **NOTE:** A resistance will be noted because of the heavy oil sealing ring.

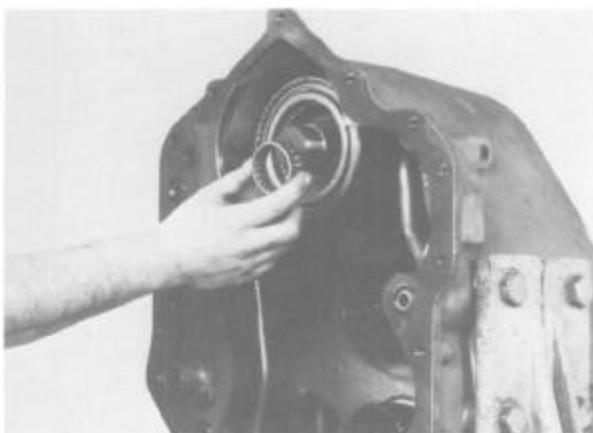


Figure 26

Remove forward clutch front pilot bearing.

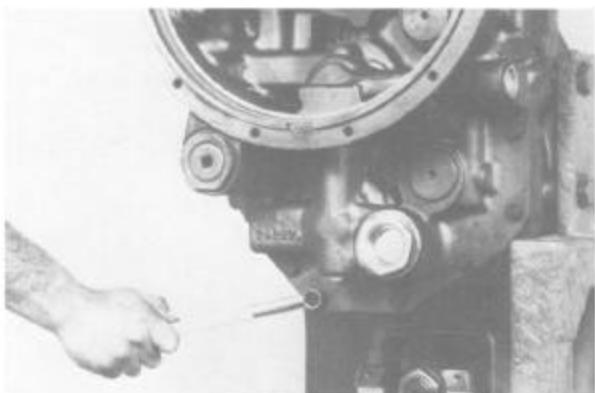


Figure 24

Support converter housing with a chain hoist. Remove converter housing to transmission case bolts.

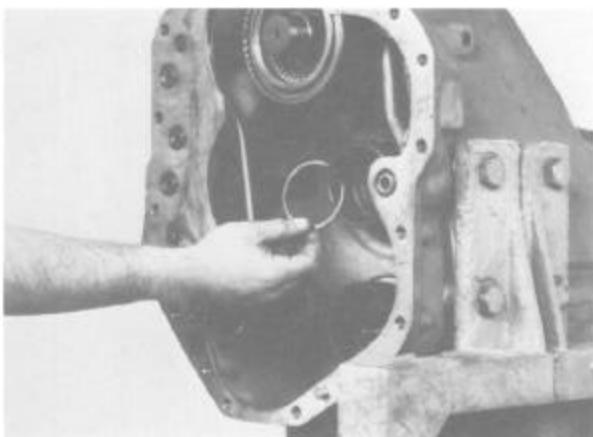


Figure 27

Remove 3rd and 4th clutch disc hub snap ring retainer outer ring.

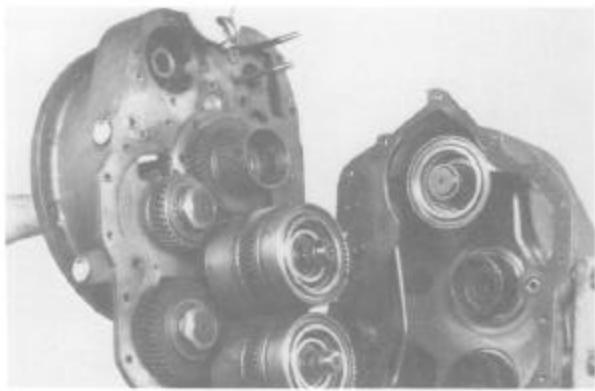


Figure 25

Separate converter housing from transmission case assembly. **NOTE:** Reverse and 3rd and 4th and Forward High and 5th and 6th clutches will remain in the converter housing.

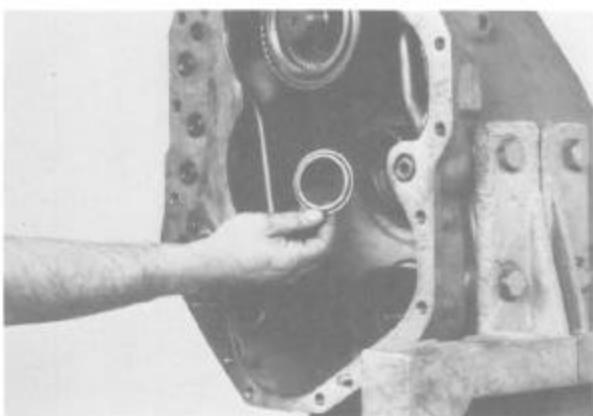


Figure 28

Remove snap ring retainer.

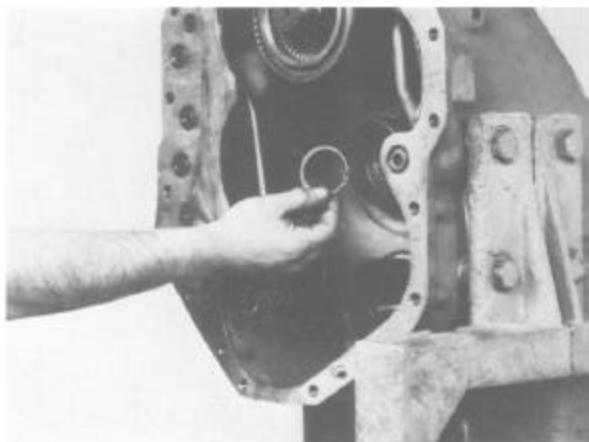


Figure 29

Remove disc hub retainer ring.

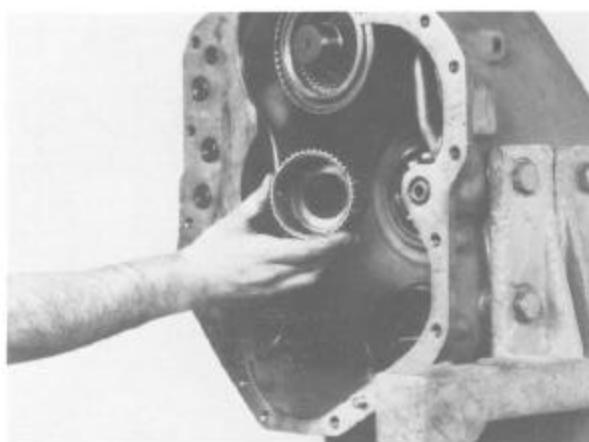


Figure 30

Remove clutch disc hub.

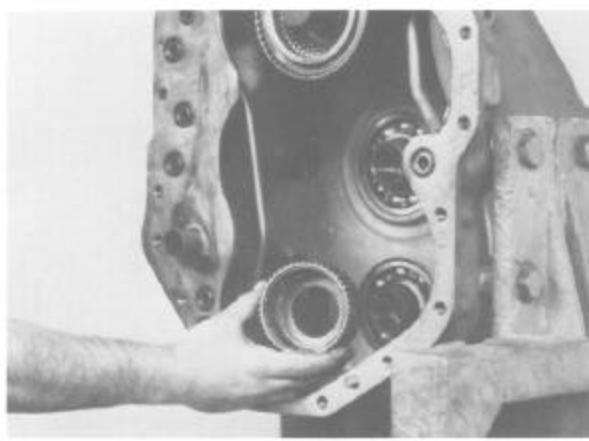


Figure 31

For 5th and 6th speed clutch disc hub removal, repeat figures 27 thru 30.

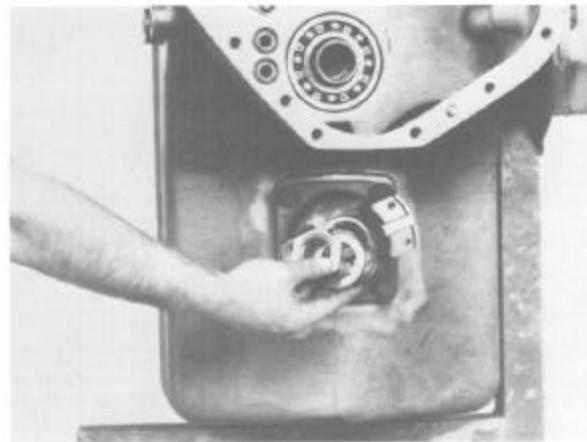


Figure 32

Using an impact wrench (if available), if not a flange retainer bar must be used to hold the companion flange from turning, loosen output flange nut. Remove nut, washer, "O" ring and flange.

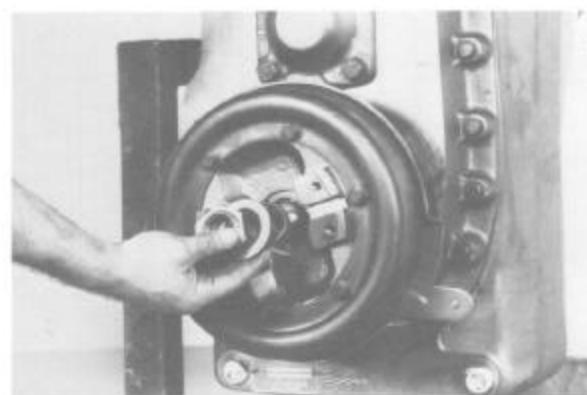


Figure 33

Remove parking brake drum flange nut, washer and "O" ring.



Figure 34

Remove brake drum.

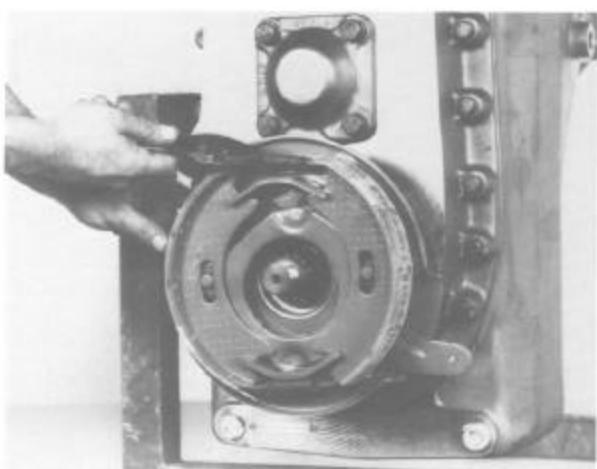


Figure 35  
Remove brake shoe return spring.

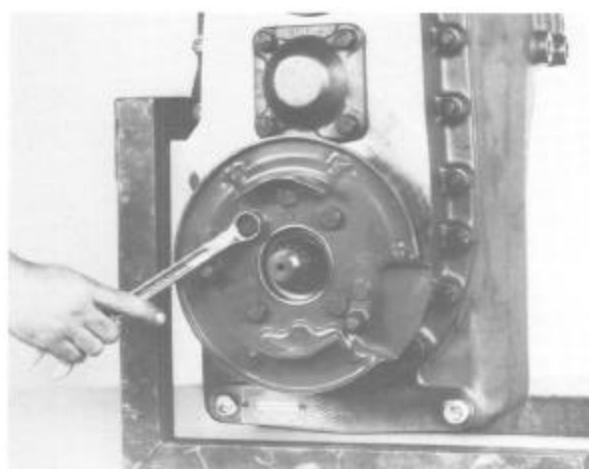


Figure 38  
Remove brake backing plate attaching bolts and washers.

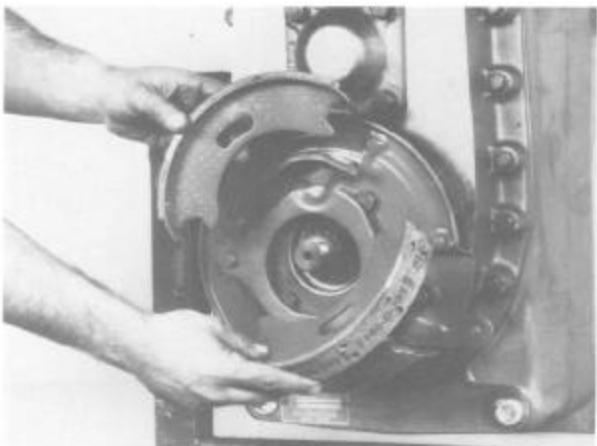


Figure 36  
Remove brake shoe and lining.

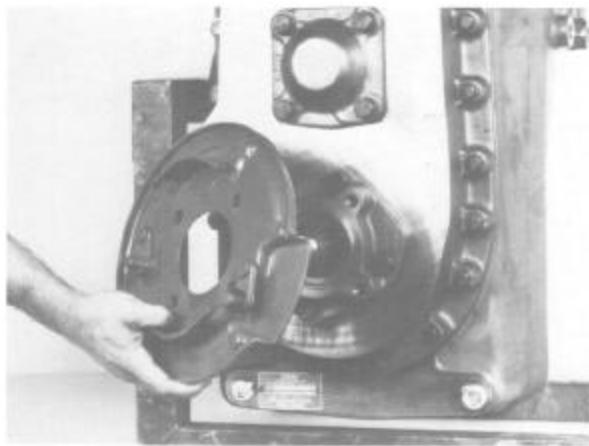


Figure 39  
Remove backing plate.

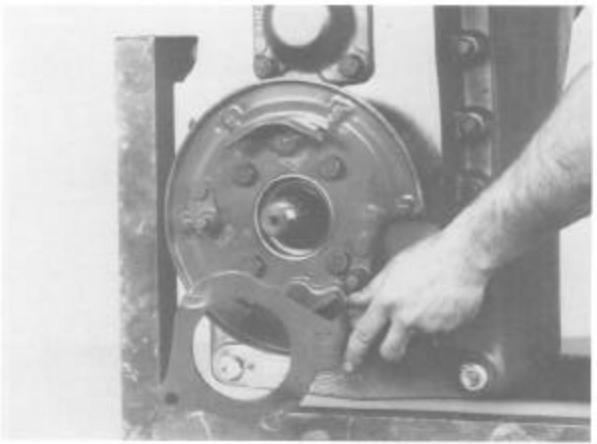


Figure 37  
Remove brake actuator lever.

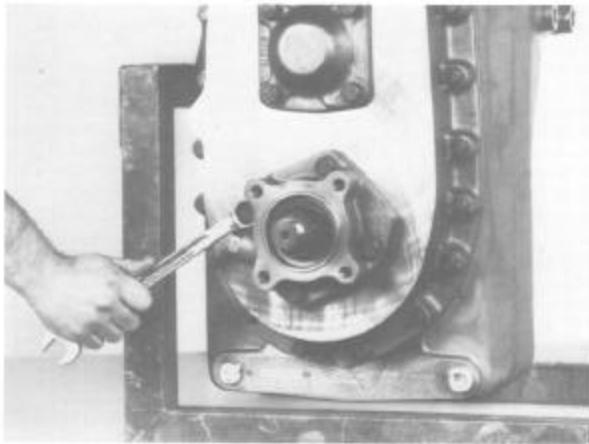


Figure 40  
Remove output shaft rear bearing cap bolts and washers.

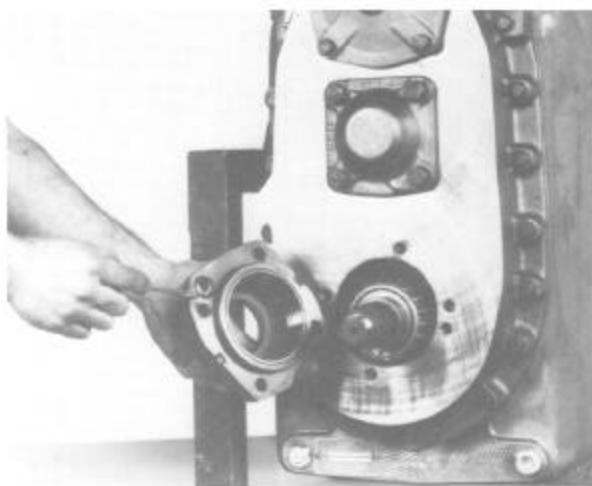


Figure 41

Remove rear bearing cap.

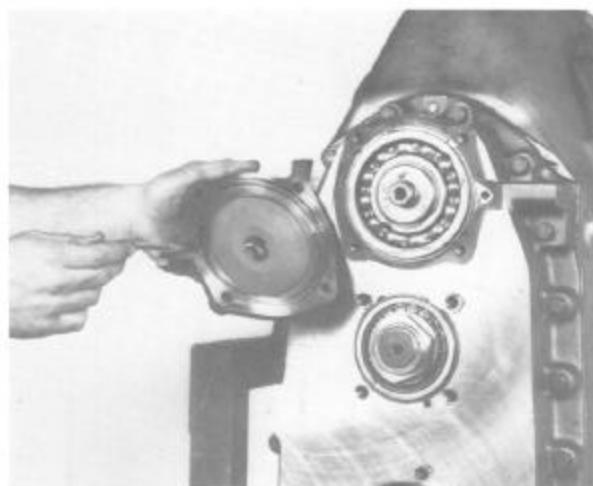


Figure 44

Remove low clutch shaft rear bearing cap bolts and washers. Remove bearing cap.

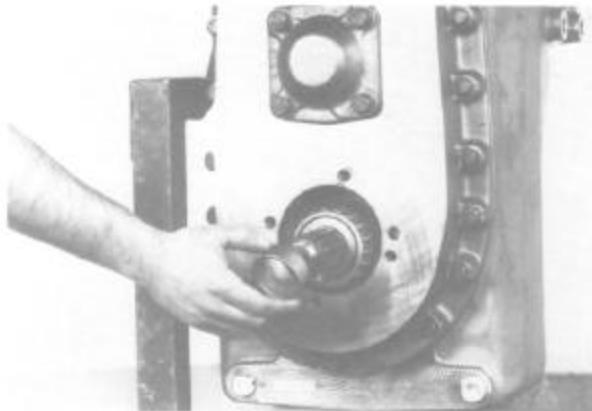


Figure 42

Remove output flange spacer.



Figure 45

Remove idler shaft rear bearing retainer nut.



Figure 43

Remove idler shaft bearing cap bolts and washers. Remove bearing cap.

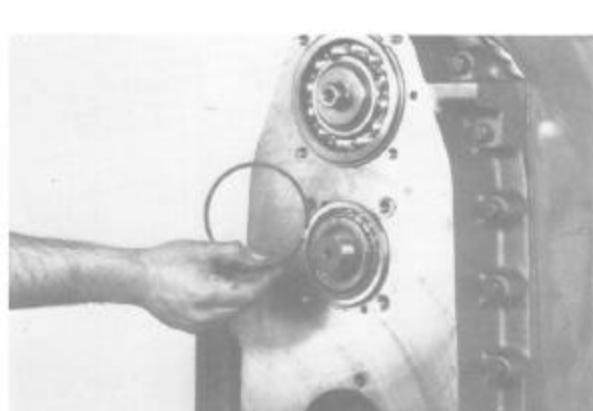


Figure 46

Remove idler shaft rear bearing locating ring.

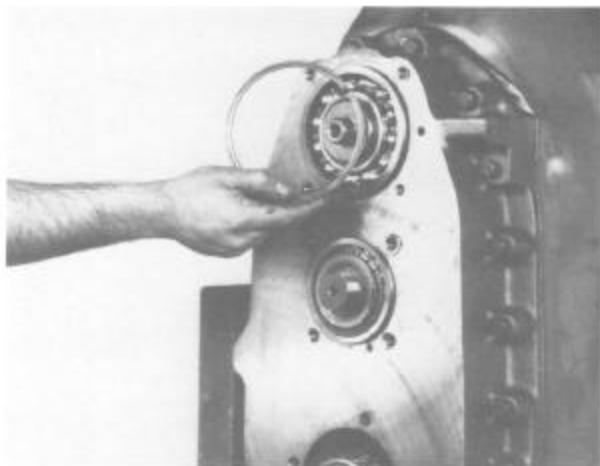


Figure 47

Remove 1st and 2nd clutch rear bearing locating ring.

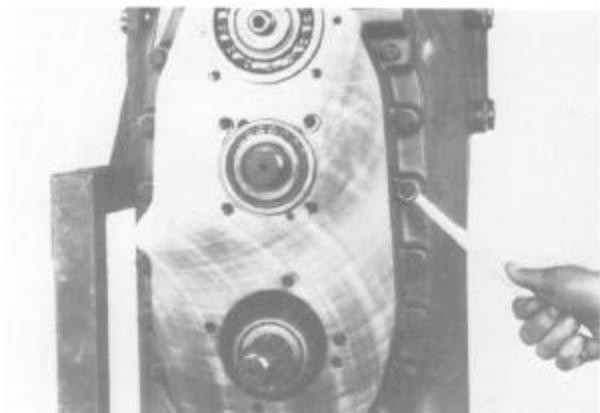


Figure 48

Remove rear cover to case screws.

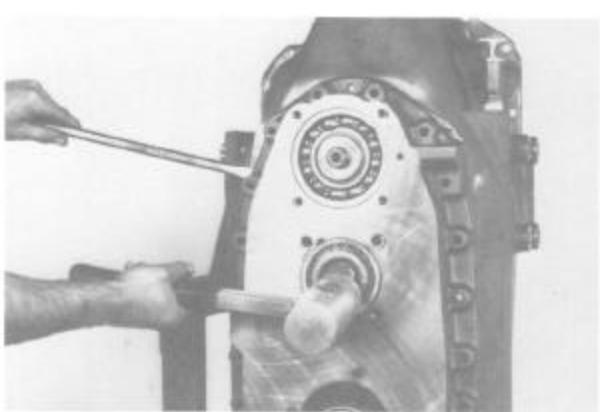


Figure 49

The use of aligning studs will facilitate the rear cover removal. Using pry slots provided, pry cover from transmission case. Using a soft hammer tap on the 1st clutch and idler shaft to prevent cover from binding.

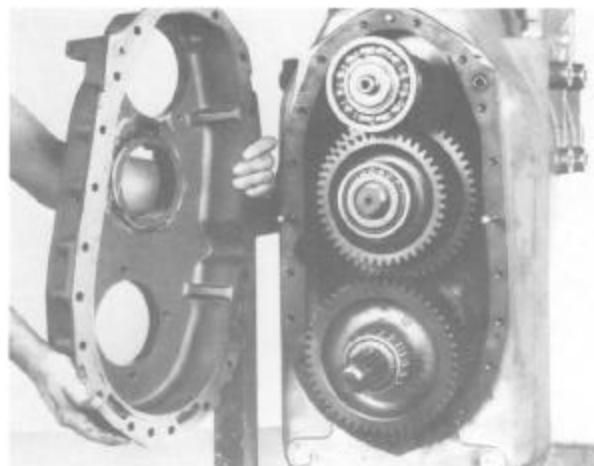


Figure 50

Remove rear cover.

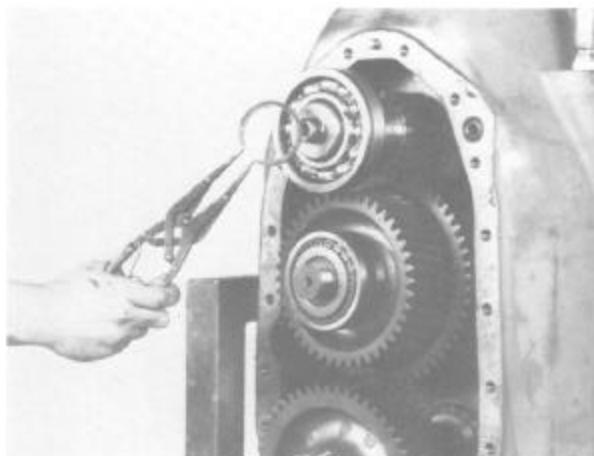


Figure 51

Remove 1st clutch rear bearing to clutch shaft retainer ring.

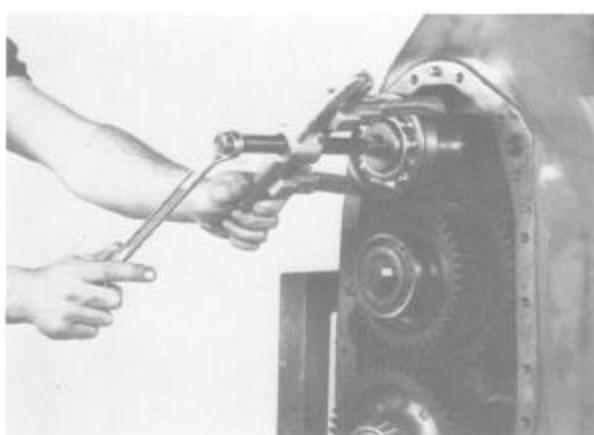


Figure 52

Remove rear bearing.

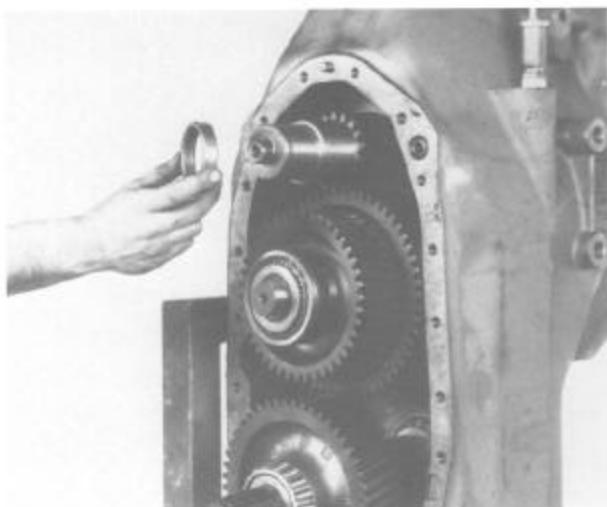


Figure 53  
Remove rear bearing spacer.

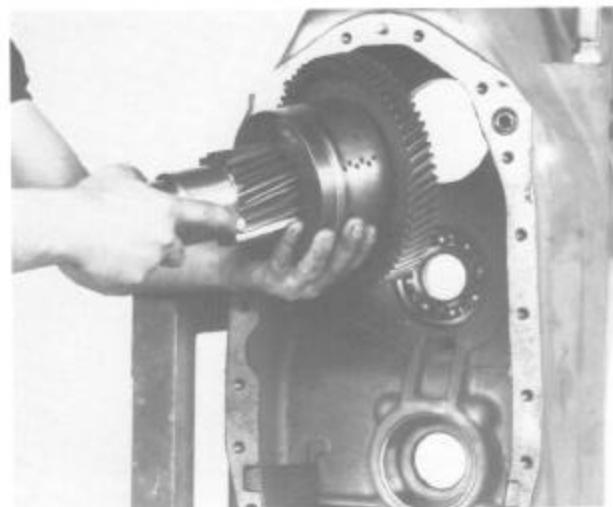


Figure 56  
Remove 1st and 2nd clutch assembly.

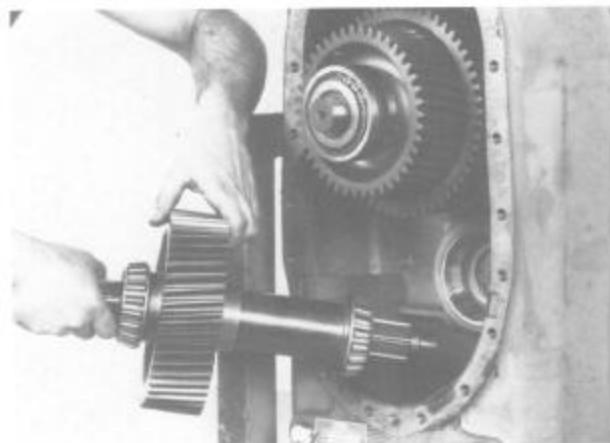


Figure 54  
Remove output shaft assembly.

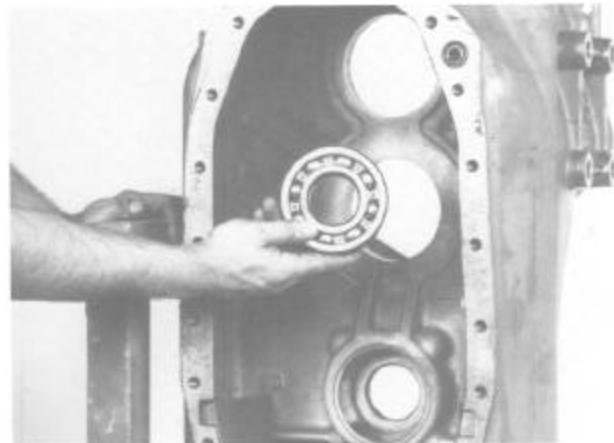


Figure 57  
Remove idler shaft front bearing.



Figure 55  
Remove idler shaft assembly.

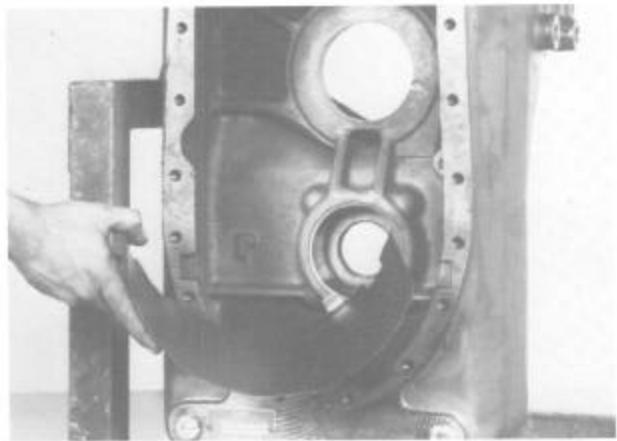


Figure 58  
Remove oil sump oil baffle.

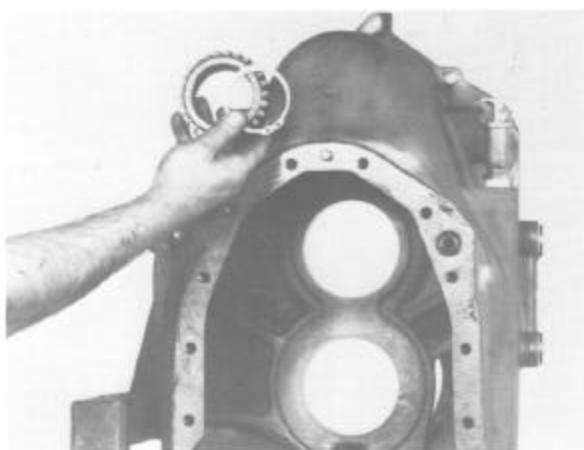


Figure 59

Remove forward clutch shaft drive gear retainer ring and drive gear. See Figure 59A.

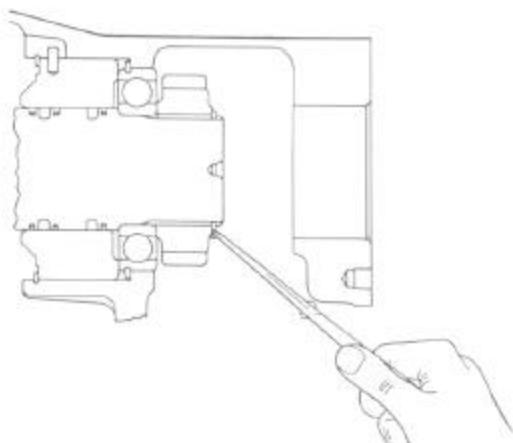


Figure 59-A

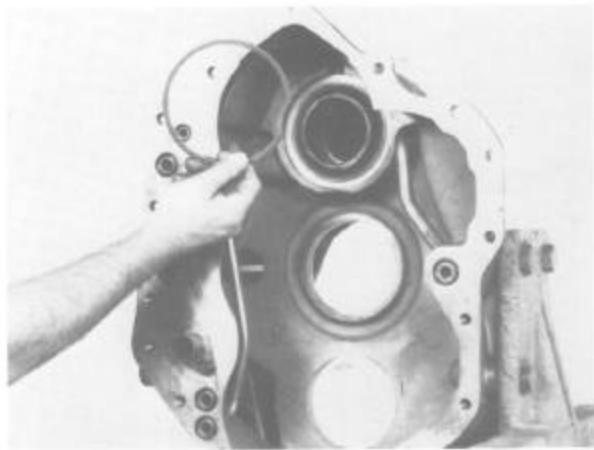


Figure 61

Remove forward clutch oil sealing ring sleeve retainer ring.



Figure 62

Remove sealing ring sleeve.



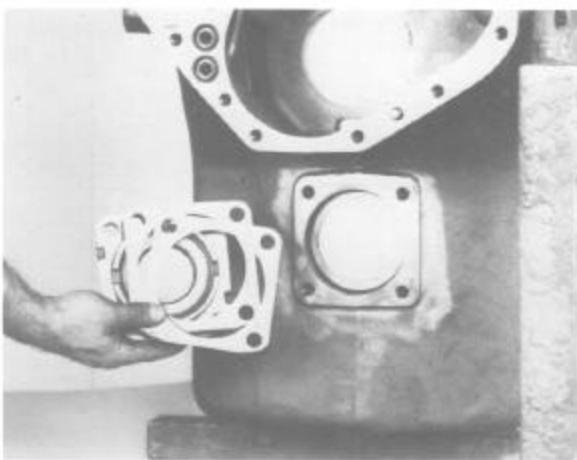
Figure 60

From the front, remove the forward clutch assembly.

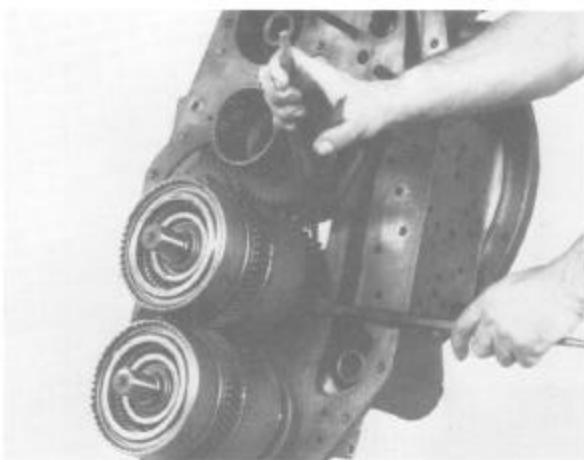


Figure 63

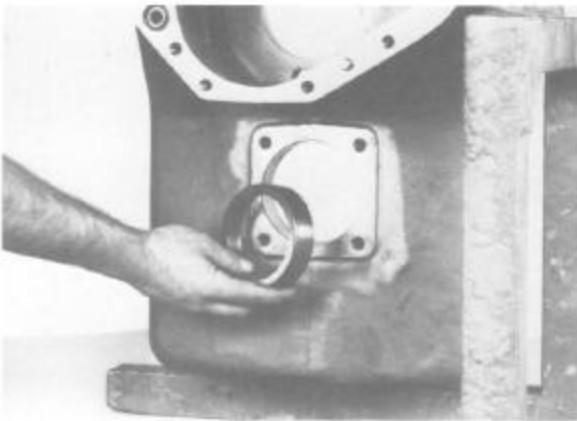
Remove forward clutch shaft rear bearing retainer ring and bearing.

**Figure 64**

Remove front output shaft bearing cap bolts and washers.  
Remove bearing cap and shims.

**Figure 67**

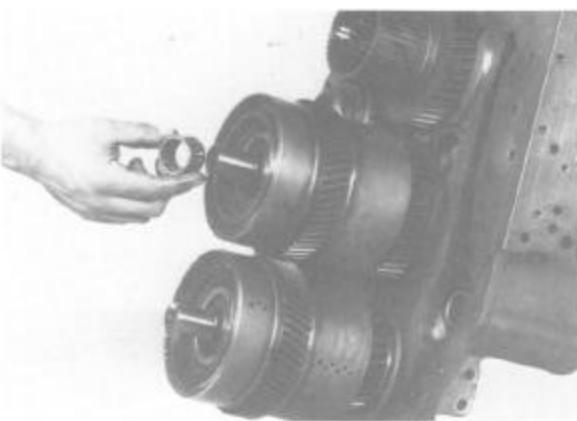
Spread reverse clutch front bearing locating ring. Pry clutch from housing.

**Figure 65**

Remove output shaft front taper bearing cup.

**Figure 68**

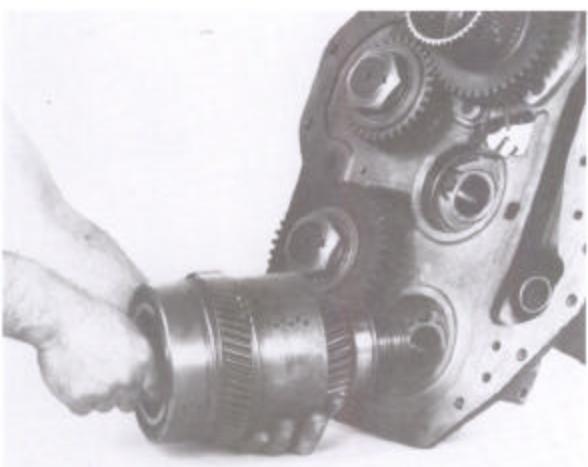
Remove reverse and 3rd and 4th clutch assembly.

**Figure 66**

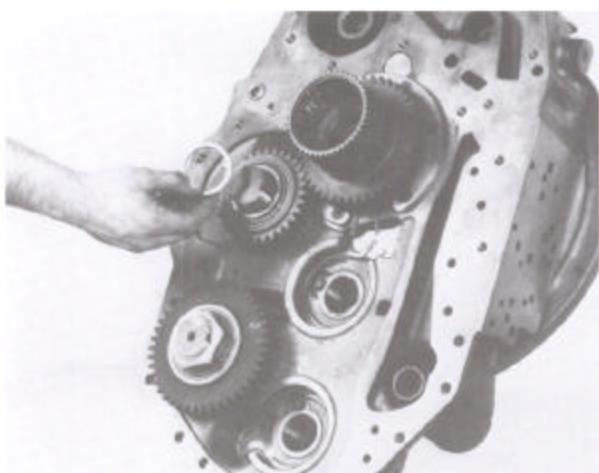
Remove clutch shaft pilot bearings.

**Figure 69**

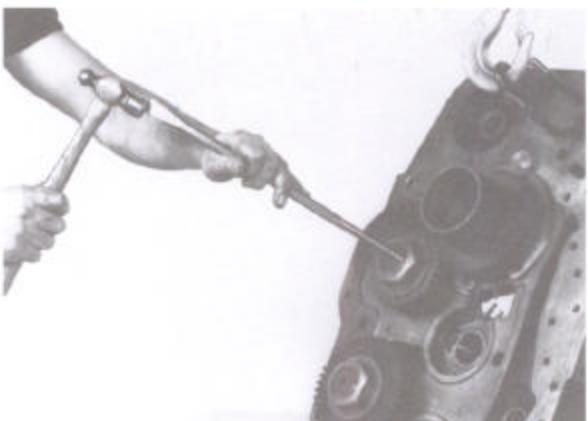
Spread forward high clutch front bearing locating ring. Pry clutch from housing.



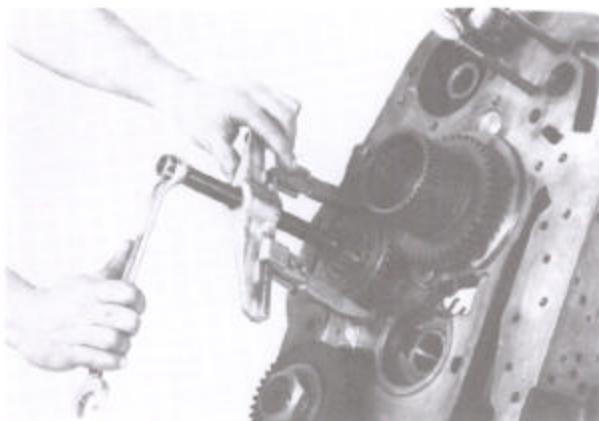
**Figure 70**  
Remove forward high and 5th and 6th clutch assembly.



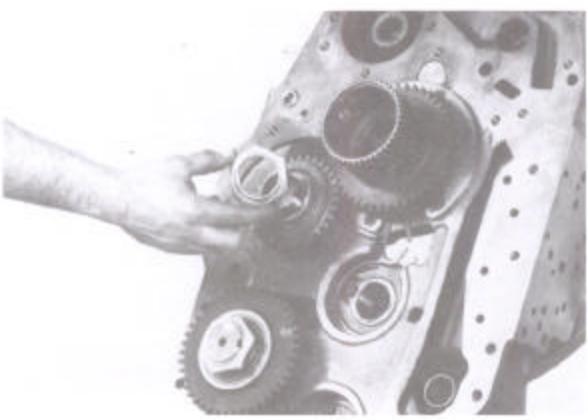
**Figure 73**  
Remove idler gear taper bearing outer thrust plate.



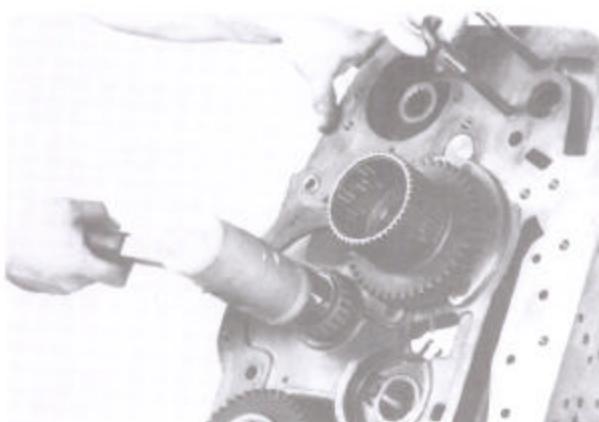
**Figure 71**  
Unclip lock nut by straightening upset metal in notch of idler shaft.



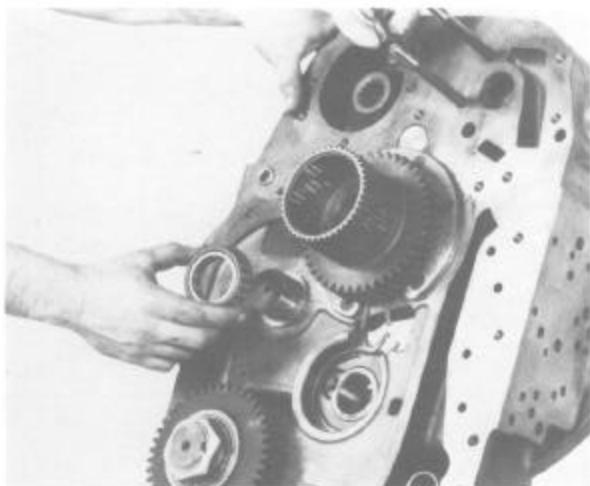
**Figure 74**  
Remove idler gear and outer taper bearing.



**Figure 72**  
Remove locknut.



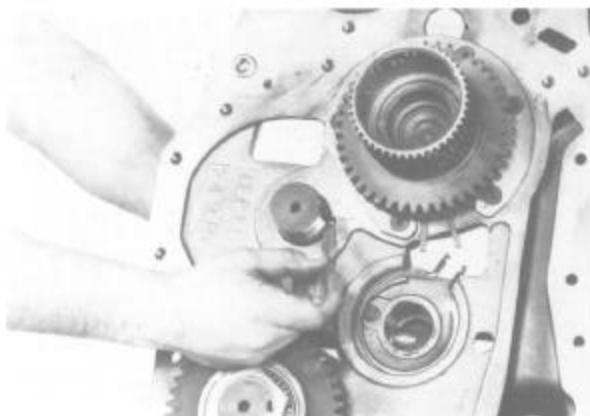
**Figure 75**  
Using a soft hammer tap idler shaft from housing to remove inner taper bearing.



**Figure 76**  
Remove inner taper bearing.



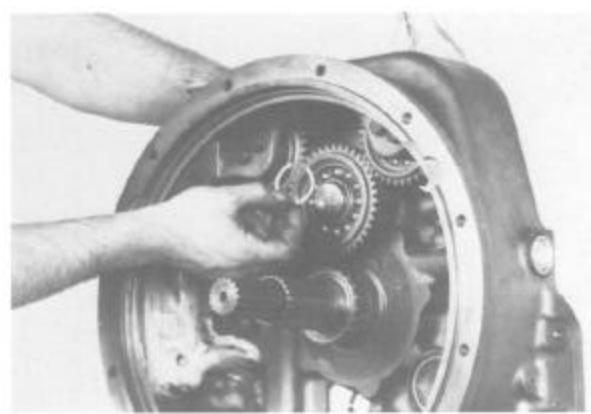
**Figure 77**  
Remove inner bearing thrust plate.



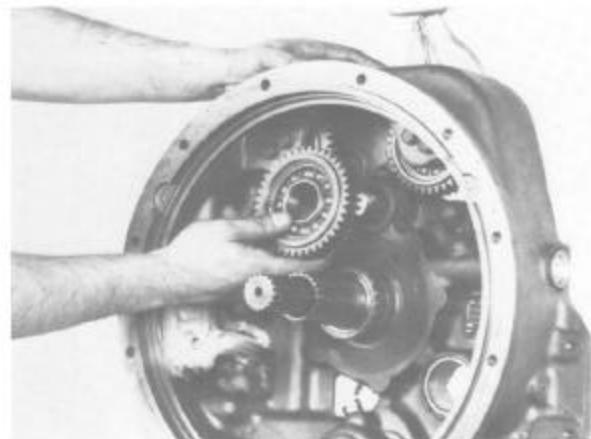
**Figure 78**  
Remove idler shaft. Use caution as not to lose shaft lockball.



**Figure 79**  
Repeat figures 71 thru 78 to remove forward high idler shaft.



**Figure 80**  
Remove pump idler gear retainer ring.



**Figure 81**  
Remove idler gear and bearing assembly.

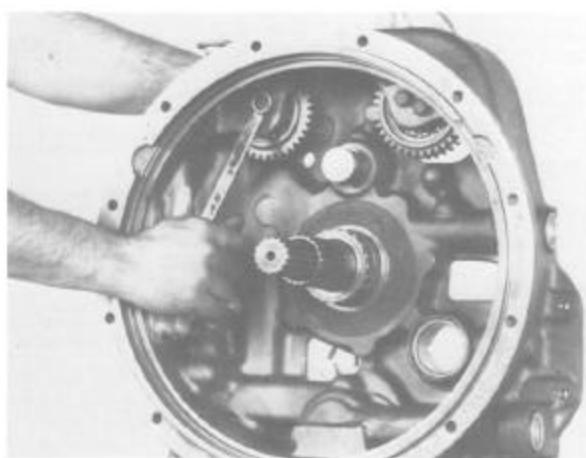


Figure 82

Remove charging pump gear support screws and lock-washers.

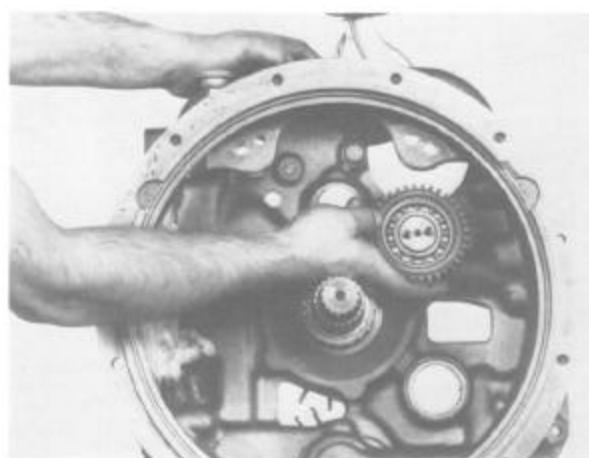


Figure 85

Remove auxiliary pump gear, bearing and support.

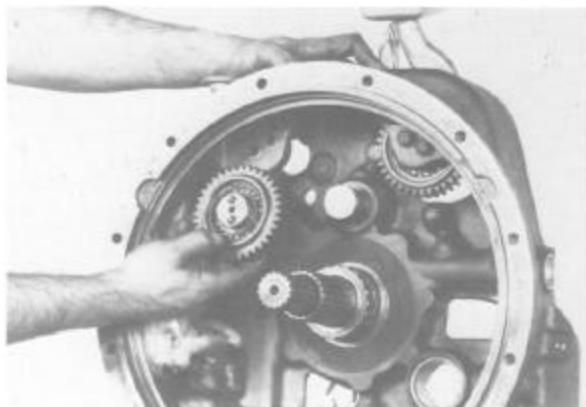


Figure 83

Remove pump gear, bearing and support.

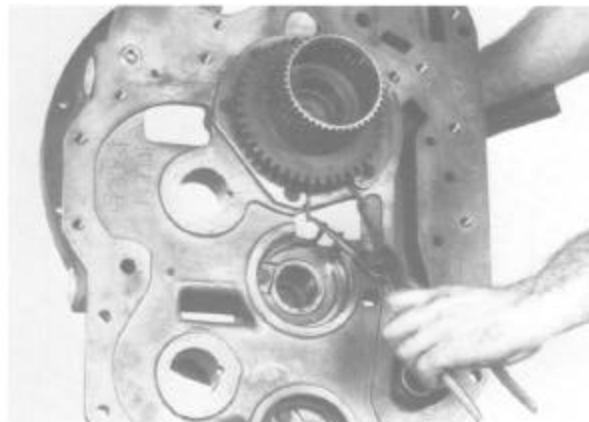


Figure 86

Spread the turbine shaft bearing locating ring.

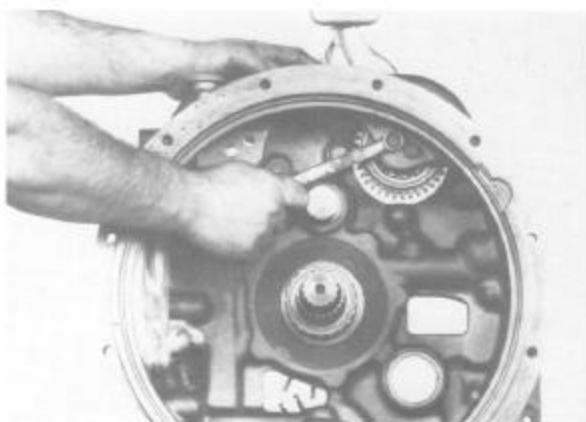


Figure 84

Remove auxiliary pump gear support screws and lock-washers.

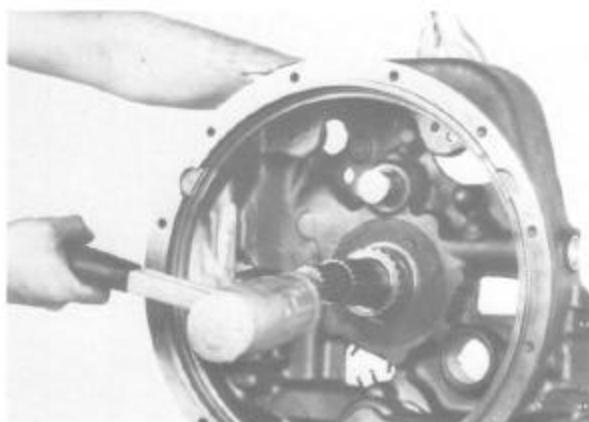


Figure 87

Holding ring open, tap turbine shaft from stator support.

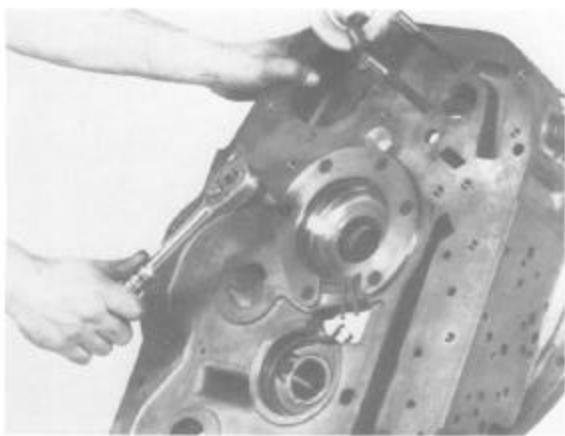


Figure 88  
Remove stator support screws and support.



Figure 91  
Remove low gear.

#### 1st AND 2nd CLUTCH DISASSEMBLY



Figure 89  
Remove front bearing.



Figure 92  
Low gear removed.



Figure 90  
Remove front bearing spacer.

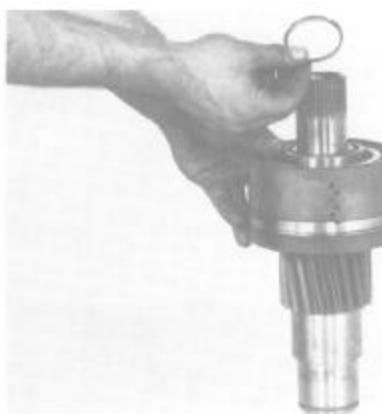
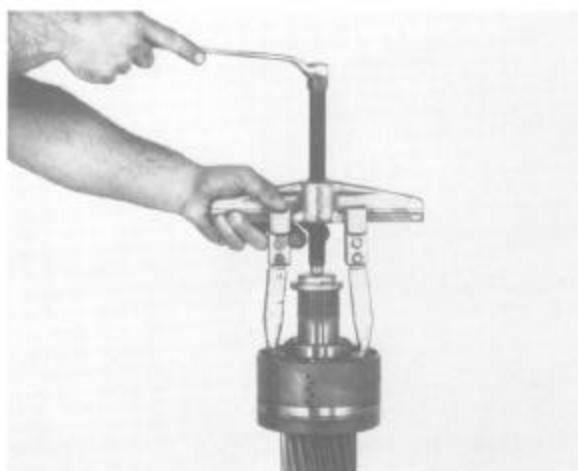


Figure 93  
Remove inner and outer bearing spacer.



**Figure 94**  
Remove end plate retainer ring.



**Figure 97**  
Remove clutch inner bearing.



**Figure 95**  
Remove end plate.



**Figure 98**  
Remove piston return disc spring retainer ring retainer.



**Figure 96**  
Remove inner and outer clutch discs.



**Figure 99**  
Remove return spring retainer ring.



Figure 100

Remove piston return disc springs. **NOTE:** Do not mix disc springs with any other disc springs as they are matched spring packs. See note Page 77.



Figure 101

Remove piston spacer.



Figure 102

Turn clutch over and tap clutch shaft on a block of wood to remove clutch piston.

See cleaning and inspection page.

#### 1st AND 2nd CLUTCH REASSEMBLY



Figure 103

Install clutch piston outer seal ring. **NOTE:** Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new seal ring as shown. Rotate piston until seal ring is flush with outer diameter of piston.



Figure 104

Install clutch piston inner seal and size as explained in figure 103.



Figure 105

Position piston in low clutch drum as shown. Use caution as not to damage inner and outer piston sealing rings.



Figure 106

Position piston return spring spacer over clutch shaft.



Figure 109

Using a sleeve with the proper inner diameter, drive the spring retainer ring into position. **NOTE:** Be certain retainer ring is in full position in ring groove.



Figure 107

Install piston return disc spring. See note Page 77. First spring with large diameter toward spacer. Alternate seven (7) springs. See Figure 110-A.



Figure 110

Position ring retainer washer over retainer ring.



Figure 108

Install piston return spring retainer ring on clutch shaft.

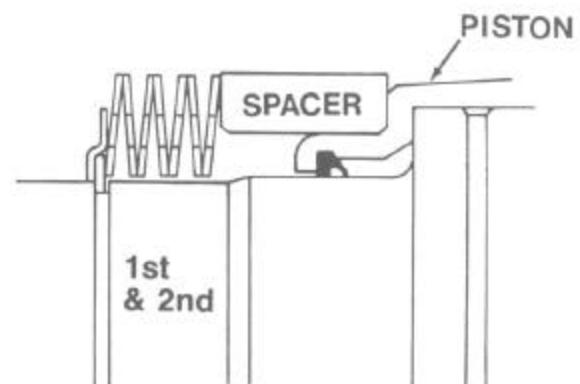


Figure 110-A



Figure 111

Install one steel disc.



Figure 114

Install end plate retainer ring.



Figure 112

Install one friction disc. **NOTE:** The friction discs in the low clutch has a higher co-efficient rating than the friction discs in the other clutches therefore the discs must not be mixed. The low clutch friction disc has a yellow mark of nonsoluble paint on the outer diameter for permanent identification. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.

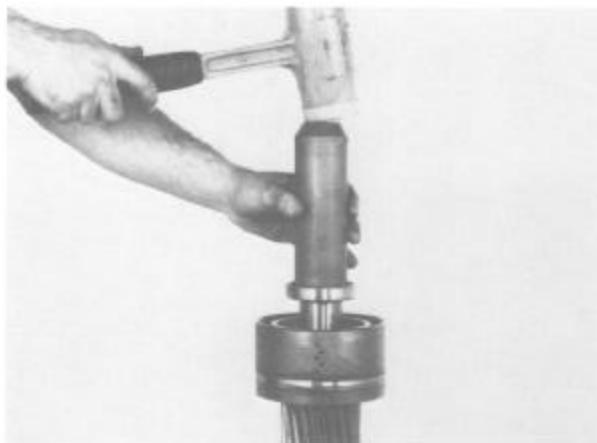


Figure 115

Install clutch gear inner bearing. **NOTE:** This bearing does not have shield in it.



Figure 113

Install clutch end plate.



Figure 116

Position bearing spacer on clutch shaft.



Figure 117

Install low clutch driven gear and hub into clutch drum. Align splines on clutch hub with internal teeth of all friction discs.



Figure 118

Install clutch gear outer bearing. **NOTE:** Outer bearing has a shield in it, this shield must be up.



Figure 119

Position front bearing spacer on clutch shaft.



Figure 120

Install front bearing.

**REVERSE, 3rd AND 4th  
CLUTCH DISASSEMBLY  
(Reverse being disassembled)**



Figure 121

Remove clutch shaft oil sealing rings and expander springs.



Figure 122

Remove front bearing retainer ring.



Figure 123

Remove front bearing.



Figure 126

Remove reverse gear.



Figure 124

Remove clutch gear bearing retainer ring.



Figure 127

Remove end plate retainer ring.



Figure 125

Pry reverse gear from clutch assembly far enough to use a gear puller.



Figure 128

Remove end plate.



**Figure 129**  
Remove inner and outer clutch discs.



**Figure 132**  
Compress piston return disc springs. Remove return spring retainer ring and ring retainer.



**Figure 130**  
Remove taper bearing spacer.



**Figure 133**  
Remove piston return disc springs.



**Figure 131**  
Remove inner taper bearing.



**Figure 134**  
Remove piston spacer.



Figure 135

Remove clutch piston.

#### DISASSEMBLY OF 3rd AND 4th CLUTCH



Figure 136

Remove end plate retainer ring.



Figure 137

Remove end plate.



Figure 138

Remove inner and outer clutch discs.  
Compress return spring retainer and remove retainer ring.



Figure 139

Remove spring retainer and return spring.

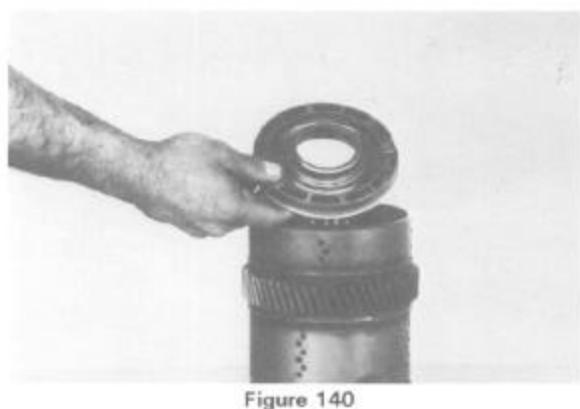


Figure 140

Remove clutch piston.

See cleaning and inspection page.

## 3rd AND 4th CLUTCH REASSEMBLY



Figure 141

Install clutch piston outer and inner seal rings. Size as explained in figure 103.



Figure 142

Install clutch piston in clutch drum. Use caution as not to damage seal rings.



Figure 143

Position piston return spring and spring retainer on clutch shaft.



Figure 144

Compress return spring and install retainer ring.



Figure 145

Install one steel disc.



Figure 146

Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.



Figure 147

Install clutch disc end plate.



Figure 148

Install end plate retainer ring.

## REVERSE CLUTCH REASSEMBLY



Figure 149

Install clutch piston outer and inner seal rings. Size as explained in Figure 103.



Figure 150

Install clutch piston in clutch drum. Use caution as not to damage seal rings.



Figure 151

Position piston return spring spacer over clutch shaft.



Figure 152

Install piston return springs. First spring with large diameter toward spacer. Alternate seven (7) springs. See note in Figure 100.



Figure 153

Install piston return spring retainer ring retainer and retainer ring on clutch shaft. Compress return springs and install retainer ring. Be sure ring is in full position in retainer.

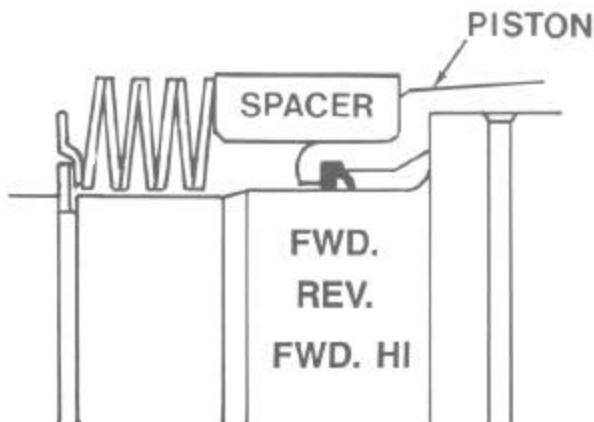


Figure 153-A



Figure 154

Install one steel disc.



Figure 157

Install end plate retainer ring.



Figure 155

Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.



Figure 158

Install clutch gear inner taper bearing, small diameter of taper up.



Figure 156

Install clutch disc end plate.



Figure 159

Position taper bearing spacer on shaft.



Figure 160

Install reverse gear into clutch drum. Align splines on reverse gear with internal teeth of friction discs. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.



Figure 163

Install clutch shaft front bearing with bearing locating ring groove up.



Figure 161

Install outer taper bearing, large diameter of taper up.



Figure 164

Install bearing retainer ring.



Figure 162

Install bearing retainer ring.



Figure 165

Install clutch shaft piston rings and expander springs per instructions on Page 78.

**DISASSEMBLY OF FORWARD HIGH  
AND 5th AND 6th CLUTCH**  
(Forward High being disassembled)  
See page 77 for special ratio cross section.



Figure 166  
Remove clutch shaft oil sealing rings and expander springs.



Figure 167  
Remove front bearing retainer ring.



Figure 168  
Remove front bearing.



Figure 169  
Remove clutch gear bearing retainer ring.



Figure 170  
Remove clutch gear and outer bearing.



Figure 171  
Remove bearing spacer.



Figure 172  
Remove end plate retainer ring.



Figure 175  
Remove clutch gear inner bearing.



Figure 173  
Remove end plate.



Figure 176  
Compress piston return disc springs. Remove spring retainer ring and ring retainer.



Figure 174  
Remove inner and outer clutch disc.



Figure 177  
Remove piston return disc springs.



Figure 178  
Remove piston spacer.



Figure 181  
Remove end plate.



Figure 179  
Remove piston.



Figure 182  
Remove inner and outer clutch discs.

#### DISASSEMBLY OF 5th AND 6th CLUTCH



Figure 180  
Remove end plate retainer ring.



Figure 183  
Compress piston return spring retainer. Remove retainer ring.



Figure 184

Remove spring retainer and return spring.



Figure 187

Install clutch piston in clutch drum. Use caution as not to damage seal rings.



Figure 185

Remove clutch piston.

See cleaning and inspection page.

#### 5th AND 6th CLUTCH REASSEMBLY



Figure 188

Position piston return spring and spring retainer on clutch shaft.



Figure 186

Install clutch piston inner and outer seal rings. Size as explained in figure 103.



Figure 189

Compress return spring and install spring retainer ring.



Figure 190

Install one steel disc.



Figure 193

Install end plate retainer ring.



Figure 191

Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction. Install end plate and snap ring.



Figure 192

Install clutch disc end plate.



Figure 194

Install clutch piston outer seal rings. Size as explained in Figure 103.



Figure 195

Install clutch piston inner seal rings. Size as explained in Figure 103.



Figure 196

Install clutch piston in clutch drum. Use caution as not to damage seal rings.



Figure 197

Position piston return spring spacer over clutch shaft.



Figure 199

Install piston return spring retainer ring retainer and retainer ring on clutch shaft. Compress return springs and install retainer ring. Be sure ring is in full position in retainer.

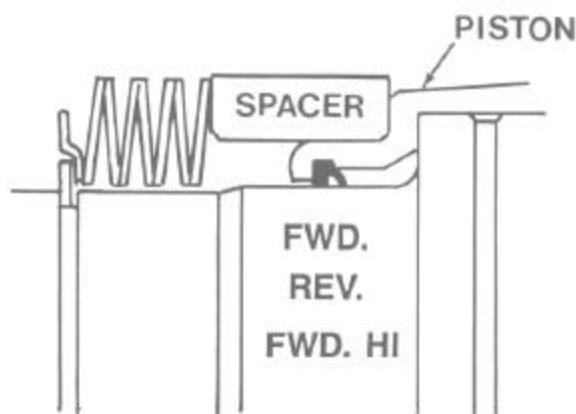


Figure 199-A



Figure 198

Install piston return springs. First spring with large diameter toward spacer. Alternate seven (7) springs. See note in Figure 100.



Figure 200

Install one steel disc.



Figure 201

Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction. Install end plate and snap ring.



Figure 202

Install clutch disc end plate.



Figure 203

Install end plate retainer ring.



Figure 204

Install clutch gear inner bearing. **NOTE:** This bearing does not have a shield in it.



Figure 205

Install clutch driven gear and hub into clutch drum. Align splines on clutch hub with internal teeth of friction discs. Tap gear into position. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.



Figure 206

Install clutch gear bearing spacer.

**Figure 207**

Install clutch gear outer bearing. **NOTE:** Outer bearing has a shield in it. This shield must be up.

**Figure 210**

Install bearing retainer ring.

**Figure 208**

Install bearing retainer ring.

**Figure 211**

Install clutch shaft piston rings and expander springs per instructions on page 78.

**Figure 209**

Install clutch shaft front bearing. **NOTE:** Bearing outer diameter locating ring groove must be up.

**Figure 212**

Remove clutch disc end plate retainer ring.



Figure 213

Remove end plate.



Figure 216

Remove piston return disc springs.



Figure 214

Remove inner and outer clutch discs.



Figure 217

Remove piston spacer.



Figure 215

Compress piston return disc springs. Remove return spring retainer ring and ring retainer.



Figure 218

Remove clutch piston.

See cleaning and inspection page.

## FORWARD CLUTCH REASSEMBLY



Figure 219

Install clutch piston outer and inner seal rings. Size as explained in Figure 103.



Figure 220

Install clutch piston in clutch drum. Use caution as not to damage seal rings.



Figure 221

Position piston return spring spacer over clutch shaft.



Figure 222

Install piston return springs. First spring with large diameter toward spacer. Alternate seven (7) springs. See note in Figure 100 and Figure 223-A.



Figure 223

Install piston return spring retainer ring retainer and retainer ring on clutch shaft. Compress return springs and install retainer ring. Be sure ring is in full position in retainer.

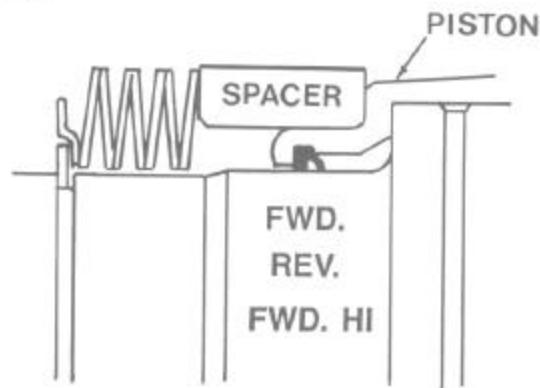


Figure 223-A



Figure 224

Install one steel disc.



Figure 227

Install end plate retainer ring.



Figure 225

Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.

#### OUTPUT SHAFT DISASSEMBLY

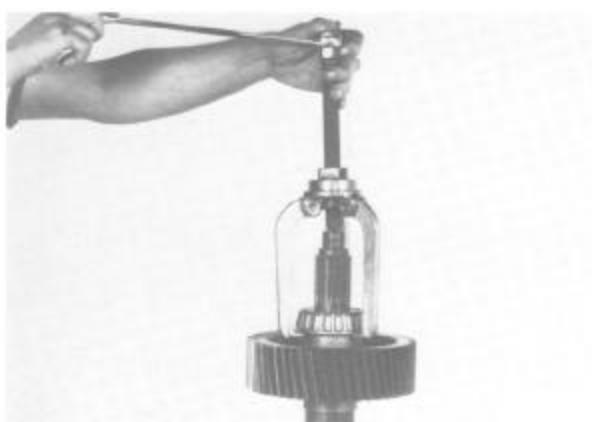


Figure 228

Remove rear bearing.



Figure 226

Install clutch disc end plate.



Figure 229

Remove output gear.



Figure 230

Remove gear spacer.



Figure 233

Position gear spacer on output shaft.



Figure 231

Remove front bearing.

See cleaning and inspection page.

#### OUTPUT SHAFT REASSEMBLY



Figure 232

Install output shaft front taper bearing, large diameter of taper down.



Figure 235

Install output shaft rear taper bearing, large diameter of taper down.

## IDLER SHAFT DISASSEMBLY



Figure 236

Pry idler shaft rear bearing up far enough to use a bearing puller.



Figure 237

Remove rear bearing.



Figure 238

Remove small idler gear.



Figure 239

Remove large idler gear.



Figure 240

Remove gear spacer.

See cleaning and inspection page.

## IDLER SHAFT REASSEMBLY



Figure 241

Position gear spacer on idler shaft.



Figure 242

Position large idler gear on shaft with long hub on gear down.



Figure 243

Position small idler gear on shaft with long hub of gear down.



Figure 244

Install idler shaft rear bearing with bearing outer locating ring groove up.

#### DISASSEMBLY OF IMPELLER COVER

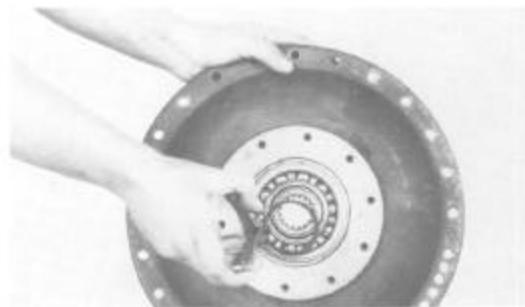


Figure 245

Remove turbine hub to impeller cover bearing retainer ring.

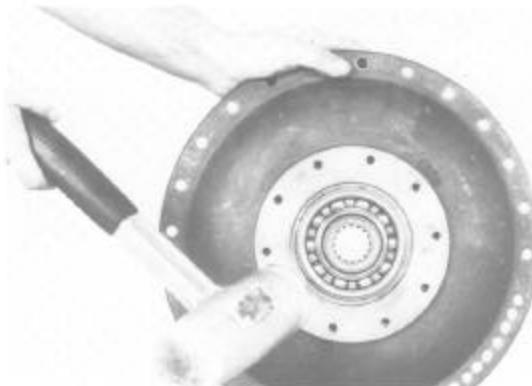


Figure 246

Tap turbine and hub from bearing.

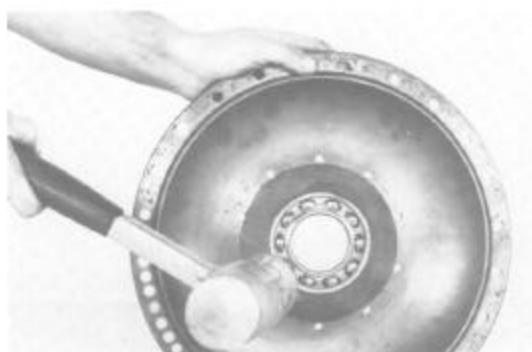


Figure 247

Tap impeller cover bearing from cover.

See cleaning and inspection page.

#### IMPELLER COVER AND TURBINE REASSEMBLY

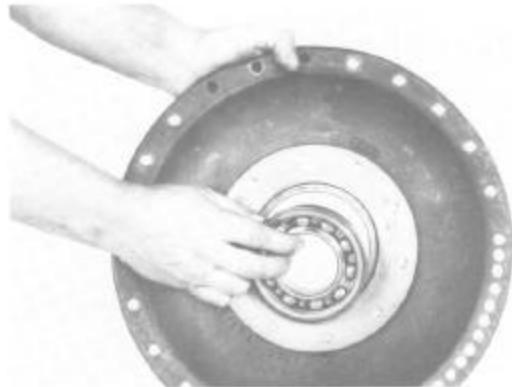


Figure 248

Install impeller cover bearing in cover with bearing locating ring up.

If the turbine or turbine hub was replaced or disassembled, this procedure must be used for reassembly.

### TURBINE HUB ASSEMBLY WITH BACKING RING AND SPECIAL SELF LOCKING SCREWS

1. Clean hub mounting surface and tapped holes with solvent. Dry thoroughly being certain tapped holes are dry and clean.
2. Install backing ring and special screws to approximately .06 inch [1.5] of seated position. With a calibrated torque wrench, tighten screws 37 to 41 lbs. ft. torque [50.2-55.6 N.m]. **NOTE:** Assembly of turbine hub must be completed within a fifteen minute period from start of screw installation. The screws are prepared with a coating which begins to harden after installation in the hub holes. If not tightened to proper torque within the fifteen minute period, insufficient screw clamping tension will result. The special screw is to be used for one installation only. If the screw is removed for any reason it must be replaced. The compound left in the hub holes must be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a new screw for reinstallation.

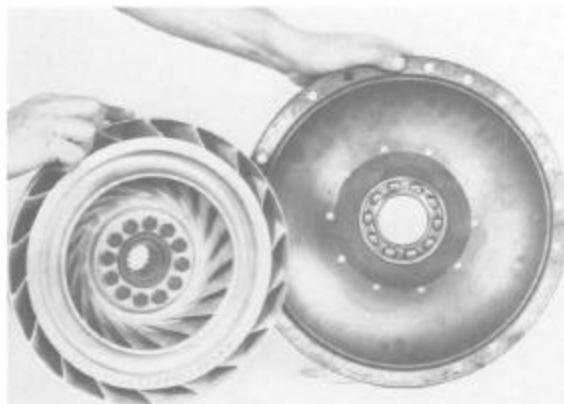


Figure 249

Position turbine assembly in impeller cover.

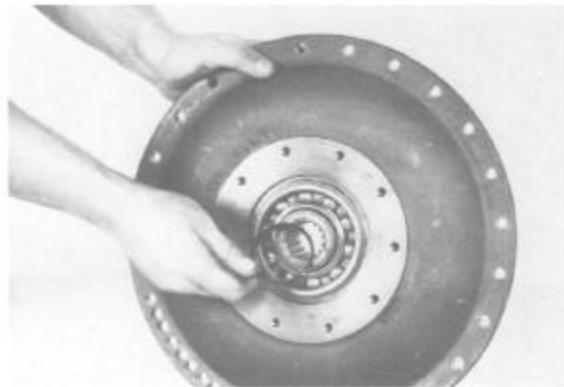


Figure 250

Install turbine hub to impeller cover bearing retainer ring.

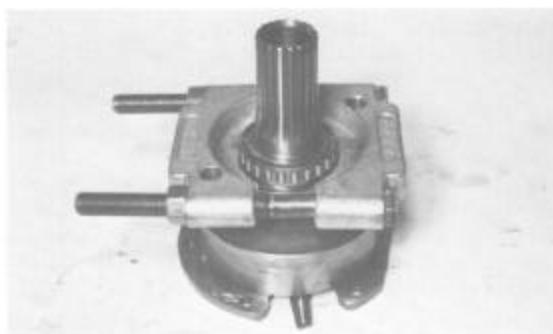


Figure 251

Remove impeller hub bearing from stator support as shown. Remove support oil sealing ring and sealing ring expander spring.

See cleaning and inspection page.

SEE FIGURE I FOR SPEED SENSOR BUSHING INSTALLATION.

### CONVERTER HOUSING REASSEMBLY



Figure 252

Install new sealing ring expander spring and oil sealing ring on support. Expander spring gap to be 180° from sealing ring hook joint. Press support bearing into position. **NOTE:** Bearing part number must be up.

Clean stator support mounting surface and tapped holes with solvent. Dry thoroughly, being certain tapped holes are clean and dry.



Figure 253

Position support in converter housing aligning holes in support with holes in housing. Tap support into position.

**STATOR SUPPORT SCREW ASSEMBLY:**

Install 6 special stator support screws. Tighten screws to 12-16 lbs. ft. [16,3-21,6 N.m] torque.

**NOTE:** Assembly of stator support to converter housing must be completed within a 15 minute period from start of screw installation. The special screw is to be used for one installation only. If the screw is removed for any reason it must be replaced. The Loctite left in the holes must be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a new screw for reinstallation.



Figure 254

With new "O" ring on shaft, position reverse idler shaft and lock ball in converter housing.



Figure 255

With new "O" ring on shaft, position idler shaft and lock ball in converter housing. Tap both shafts into position.

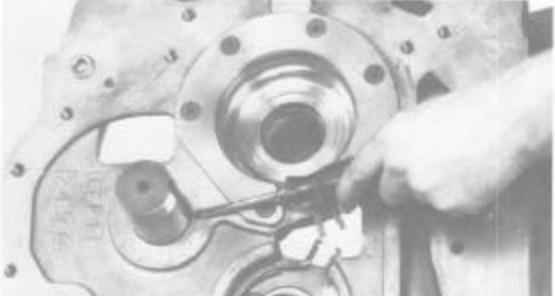


Figure 256

Note lock ball in position in both shafts.

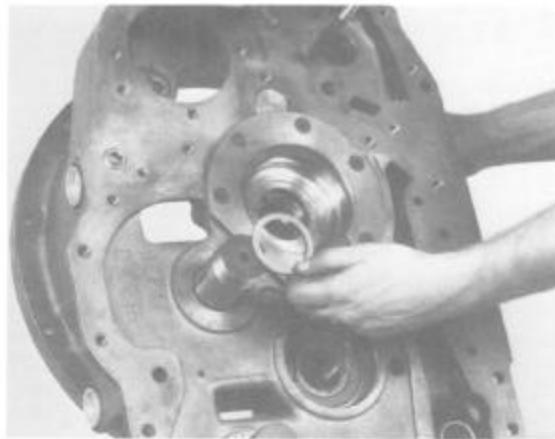


Figure 257

Install reverse idler shaft spacer.

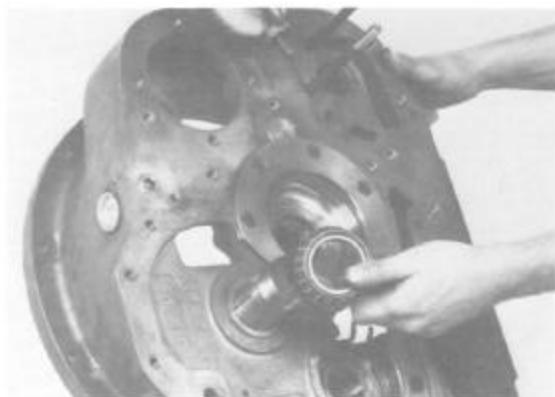


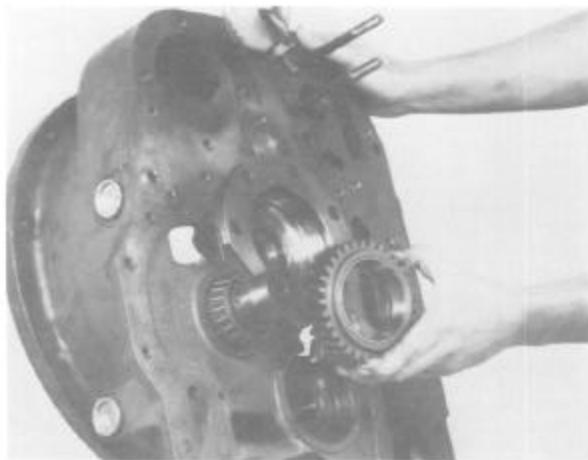
Figure 258

Install idler gear inner taper bearing on shaft with large diameter of taper down.

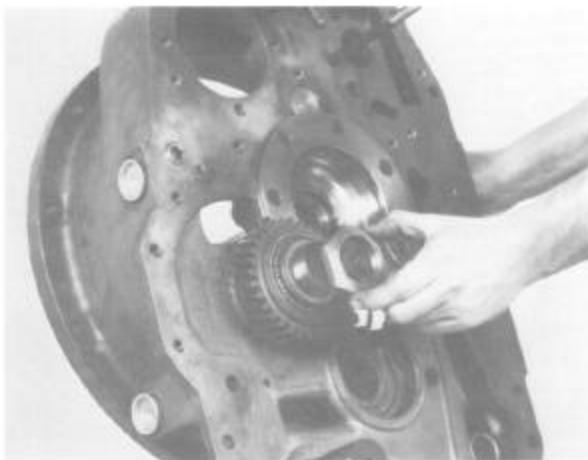


Figure 259

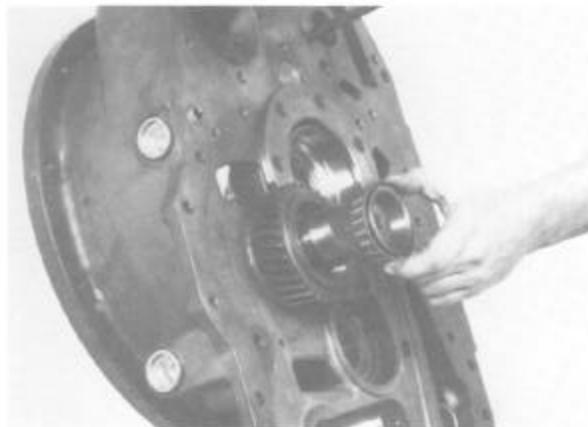
Position bearing spacer on shaft.

**Figure 260**

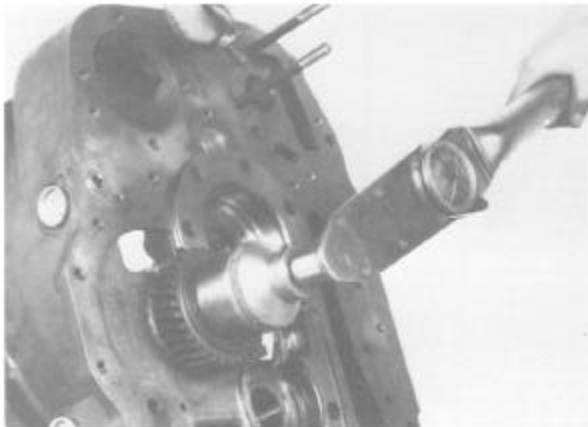
Position idler gear on bearing with hub of gear up.

**Figure 263**

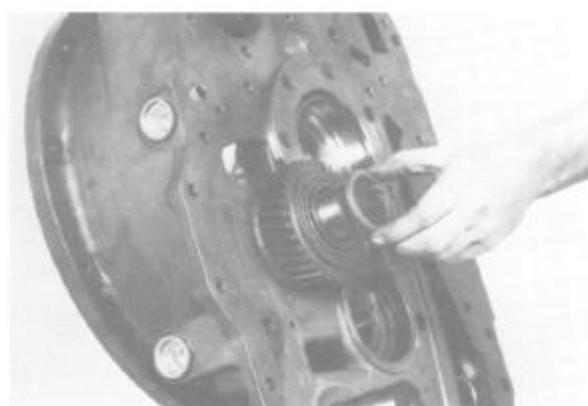
Install retainer nut on shaft.

**Figure 261**

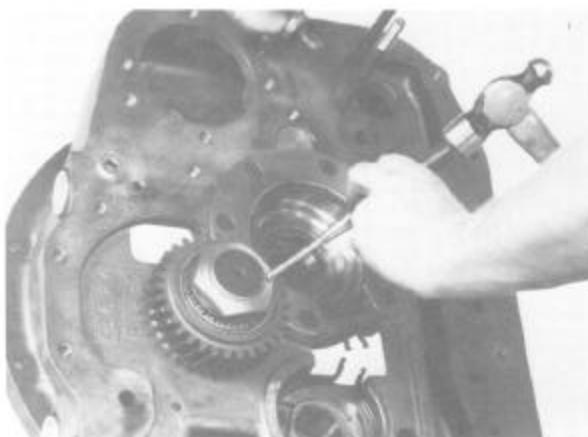
Install idler gear outer taper bearing on shaft with large diameter of taper up.

**Figure 264**

Tighten nut 200 to 250 ft. lbs. torque [271,2-338,8 N.m].

**Figure 262**

Position outer spacer on shaft.

**Figure 265**

Stake nut securely into shaft notch.



Figure 266

If bearing was removed, press turbine shaft bearing into position. Install bearing washer and retainer ring. Install new turbine shaft oil sealing ring.



Figure 267

Spread ears on turbine shaft bearing retainer ring located in reaction member support. Tap turbine shaft and bearing into position, being certain bearing snap ring is in full position in snap ring groove.

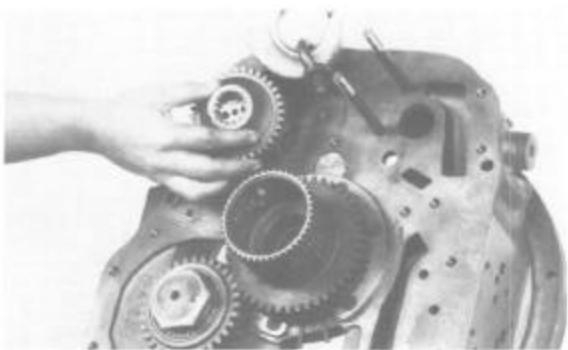


Figure 268

Position auxiliary pump drive gear, bearing and support in housing.



Figure 269

Align holes in bearing support with holes in housing. Install support screws and lockwashers, tighten 23 to 25 ft. lbs. torque [31,2-33,8 N.m].

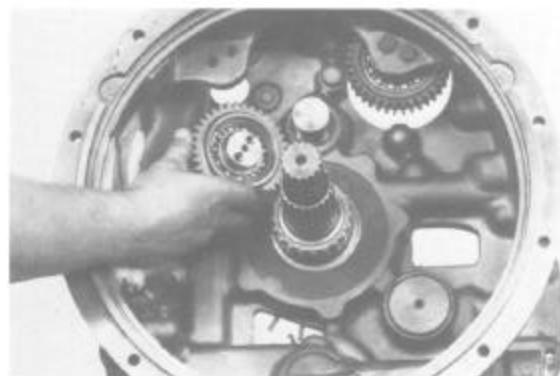


Figure 270

Position charging pump drive gear, bearing and support in housing.

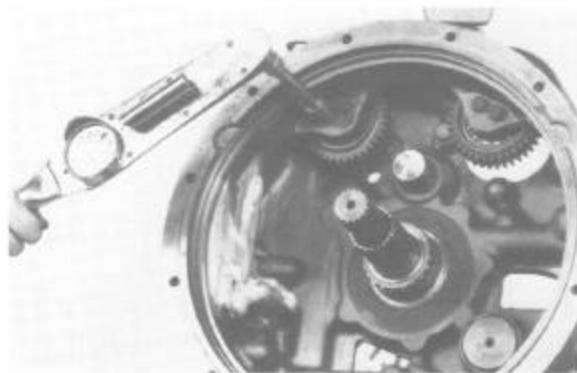
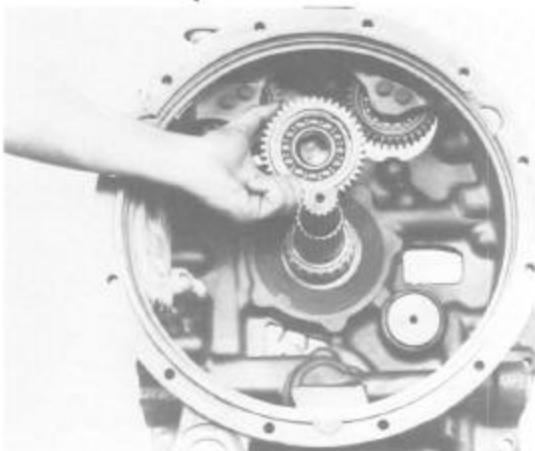
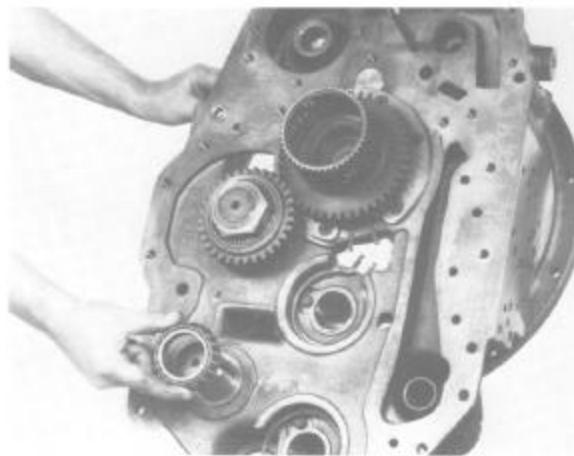


Figure 271

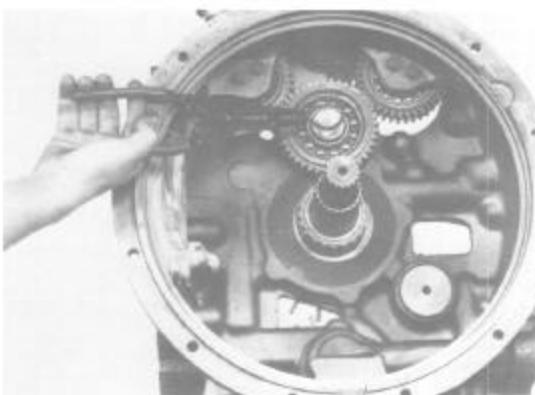
Install support screws and tighten 23 to 25 ft. lbs. torque [31,2-33,8 N.m]

**Figure 272**

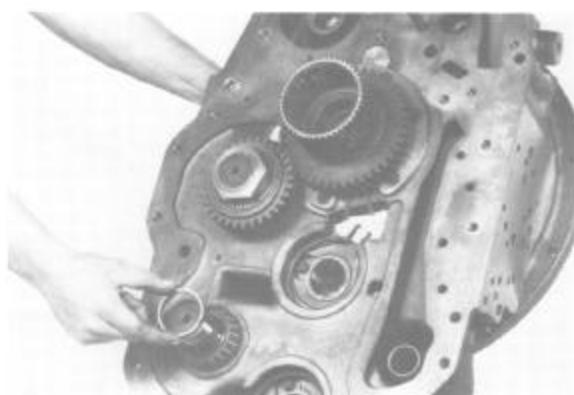
Position pump drive idler gear and bearing on idler gear stub shaft.

**Figure 275**

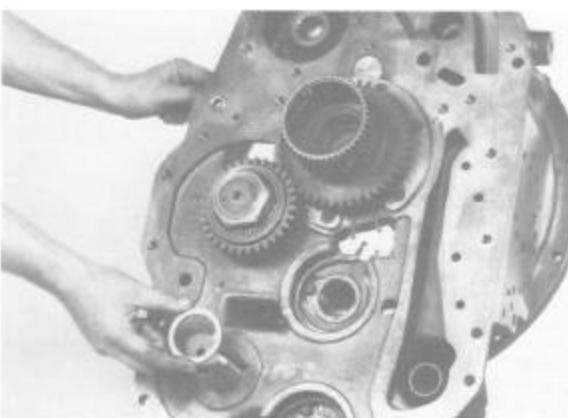
Install idler gear inner taper bearing on shaft with large diameter of taper down.

**Figure 273**

Install idler gear to stub shaft retainer ring.

**Figure 276**

Position bearing spacer on shaft.

**Figure 274**

Install idler shaft spacer.

**Figure 277**

Position idler gear on bearing with hub of gear up.



Figure 278

Spread ears on forward high clutch front bearing locating ring. **NOTE:** The idler gear and taper bearing cup assembly and the forward high clutch assembly must be installed in the converter housing at the same time as the idler gear must be positioned between the forward clutch front bearing and the clutch drum. Install the idler outer taper bearing with small diameter of taper down. Make sure locating ring is in full position in ring groove.

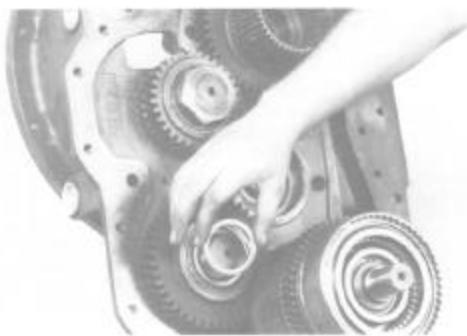


Figure 279

Position outer spacer on shaft.



Figure 280

Install retainer nut on shaft and tighten 200 to 250 ft. lbs. torque [271.2-338.9 N.m]. Stake nut securely into shaft notch.

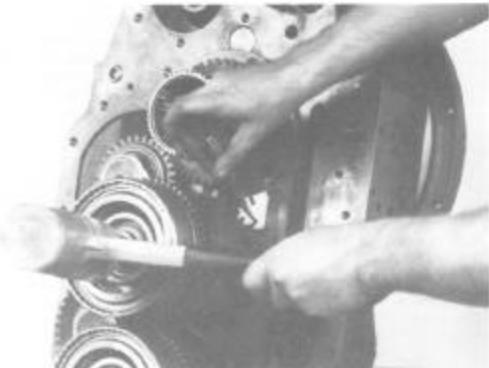


Figure 281

Spread ears on reverse clutch front bearing locating ring. Tap reverse and 3rd and 4th clutch assembly into converter housing. Align the snap ring groove in the bearing with the snap ring in the housing, being certain bearing snap ring is in full position in snap ring groove.

See cleaning and inspection page.

SEE FIGURE I FOR SPEED SENSOR BUSHING INSTALLATION.

#### REASSEMBLY OF TRANSMISSION

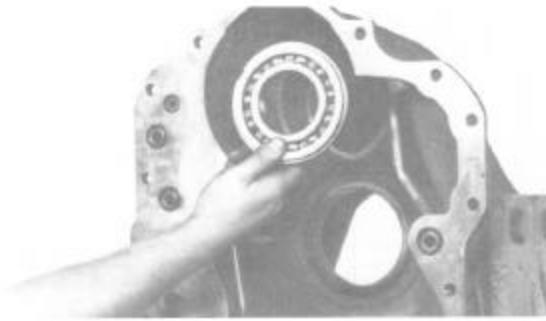


Figure 282

Install forward clutch shaft rear bearing into bearing bore with bearing snap ring toward front of housing.

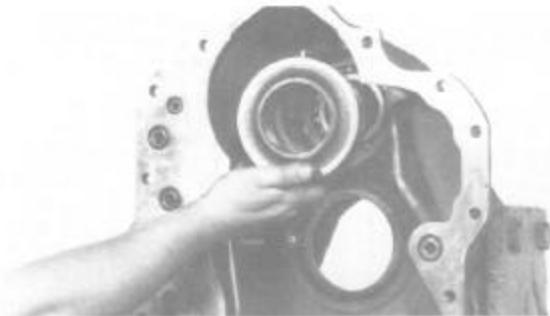
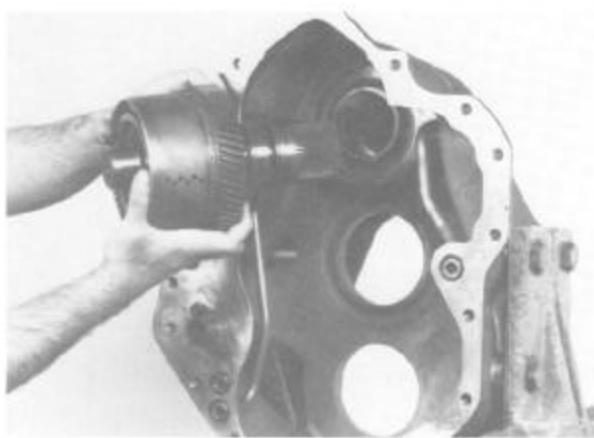
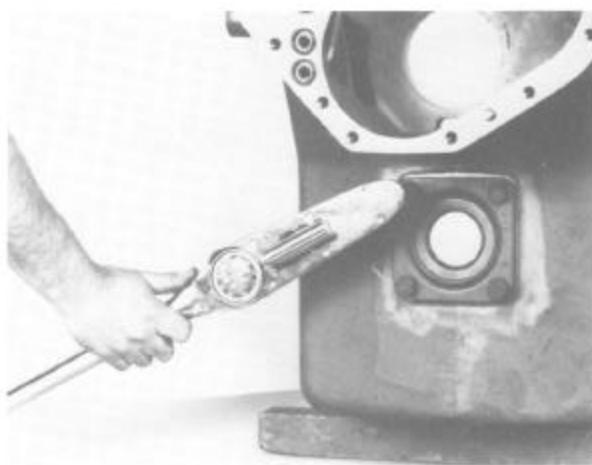


Figure 283

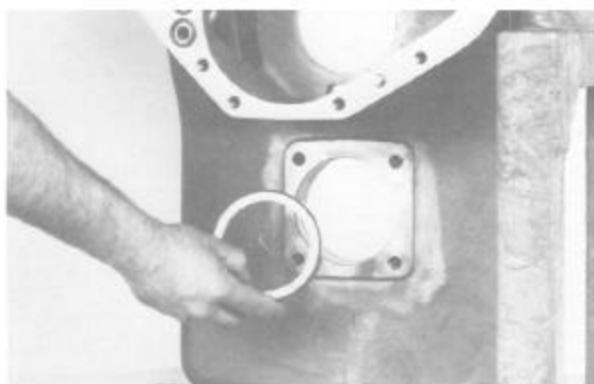
Align forward clutch shaft piston ring sleeve with groove in housing. Tap sleeve into position and secure with sleeve retainer ring.

**Figure 284**

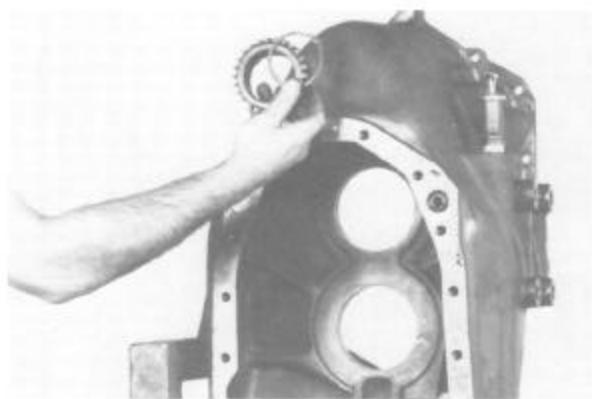
Position forward clutch assembly into transmission housing. Use caution as not to damage forward shaft piston rings. Tap clutch into position.

**Figure 287**

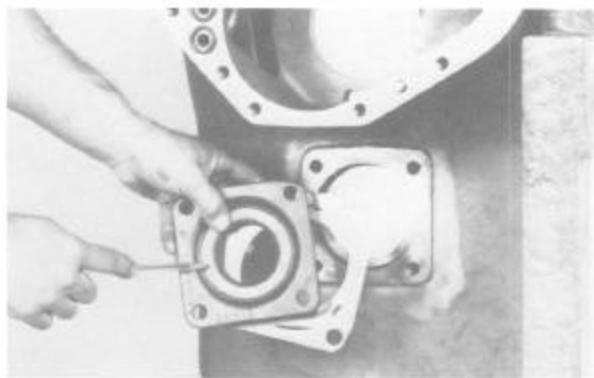
Install bearing capscrews and washers and tighten to specified torque.

**Figure 285**

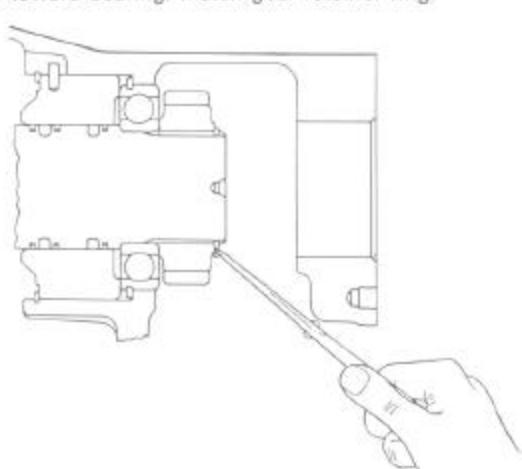
Install output shaft front taper bearing cup.

**Figure 288**

Position forward gear on forward clutch shaft with long hub of gear toward bearing. Install gear retainer ring.

**Figure 286**

Coat outer diameter of oil seal with Permatex #2 and press seal in bearing cap with lip of seal in. Remove any excess sealant. Install new "O" ring on bearing cap. Install front bearing cap and shims.

**Figure 288-A**

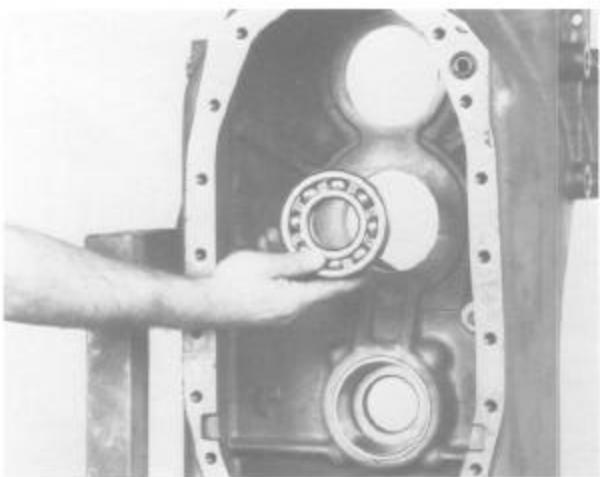


Figure 289  
Install idler shaft front bearing.

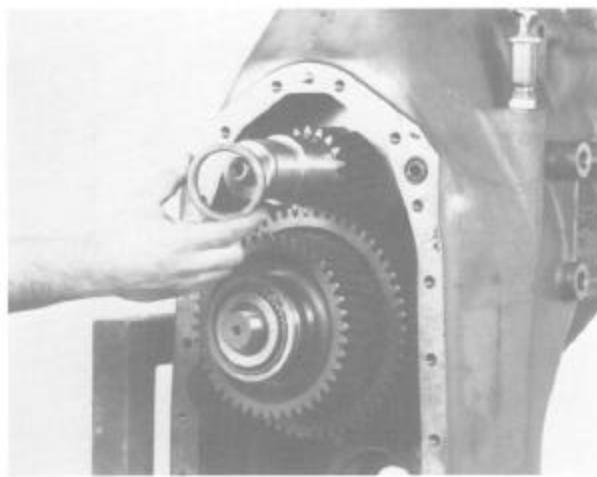


Figure 292  
Position rear bearing spacer on clutch shaft.

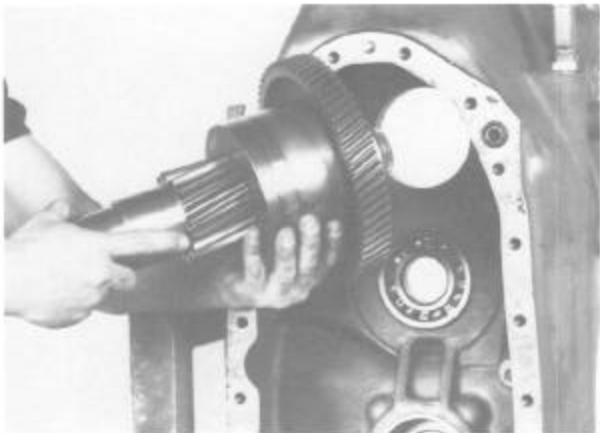


Figure 290  
Position 1st and 2nd speed clutch in front bearing bore and tap into place.

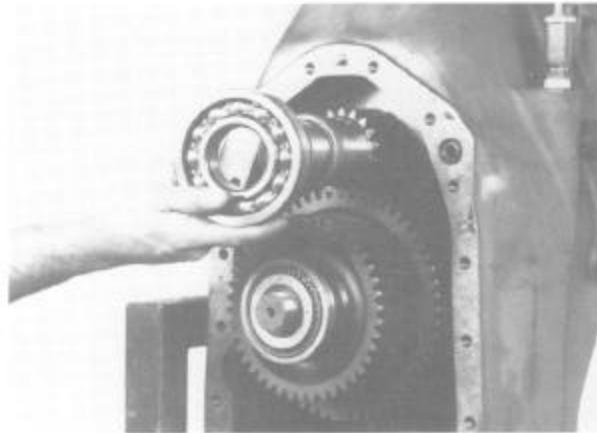


Figure 293  
Install 1st and 2nd clutch rear bearing on clutch shaft.  
NOTE: Bearing locating ring groove must be out.

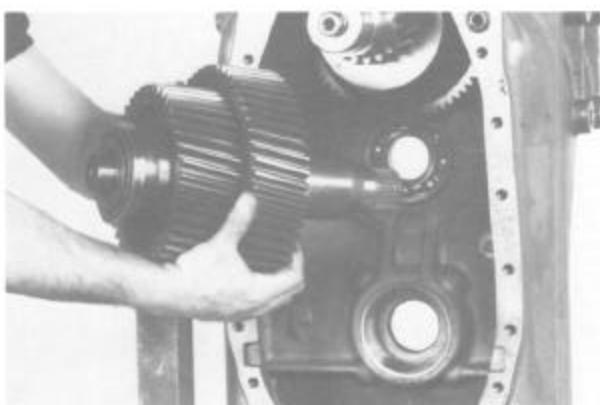


Figure 291  
Install idler shaft assembly into front bearing.

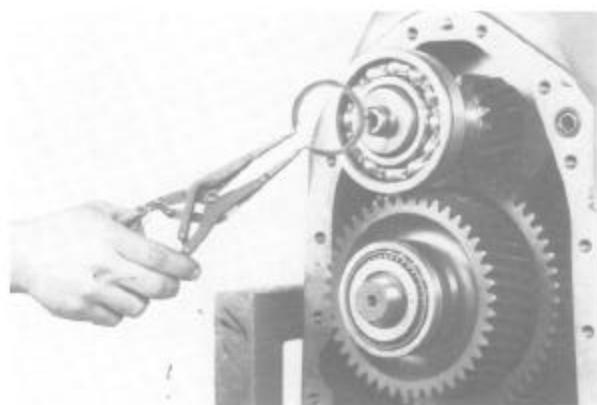
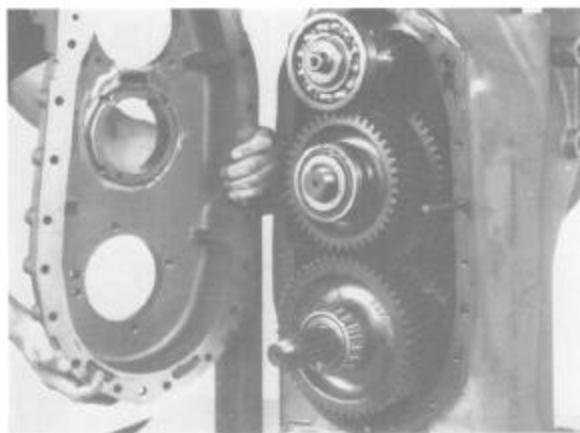


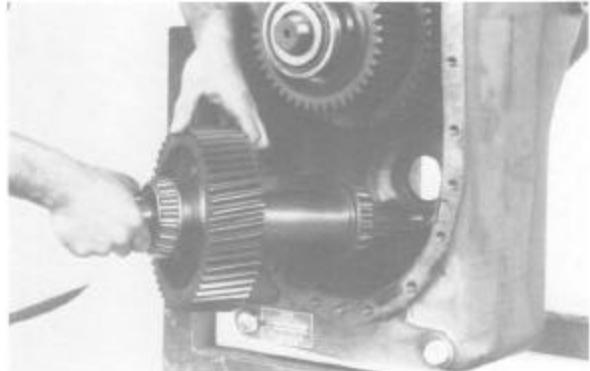
Figure 294  
Install bearing retainer ring.

**Figure 295**

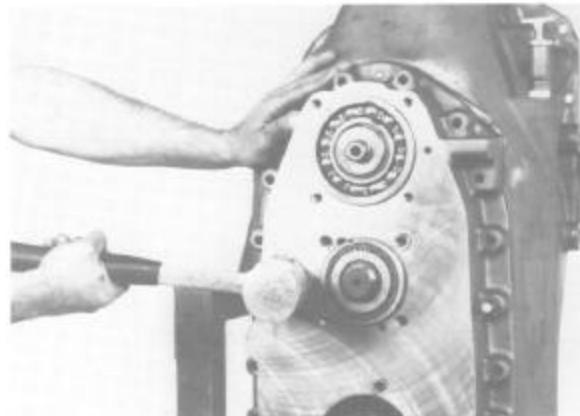
Position oil baffle in transmission sump.

**Figure 298**

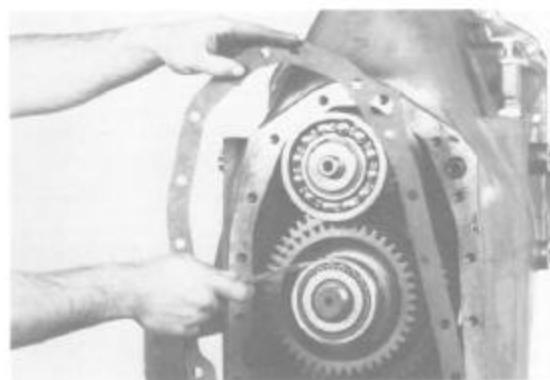
Align lock ball in idler shaft rear bearing with notch in rear transmission cover.

**Figure 296**

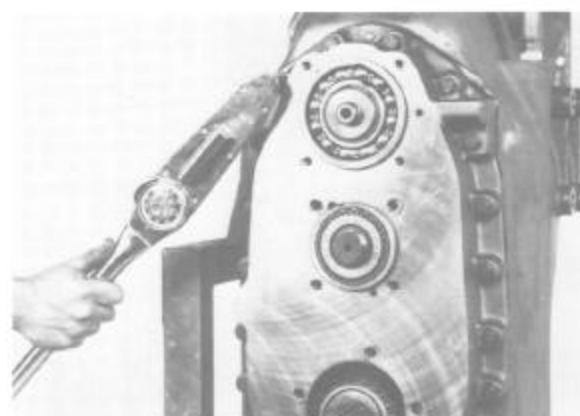
Position output shaft assembly in front bearing bore, use caution as not to damage front oil seal.

**Figure 299**

Tap cover in place and secure with bolts and lockwashers. Remove aligning studs.

**Figure 297**

Position a new gasket and "O" ring on rear of housing. A light coat of chassis grease will hold the gasket in place. Install two aligning studs in housing, this will facilitate alignment of rear cover to housing. Position lock ball in idler rear bearing.

**Figure 300**

Tighten cover bolts to specified torque. (See torque chart)

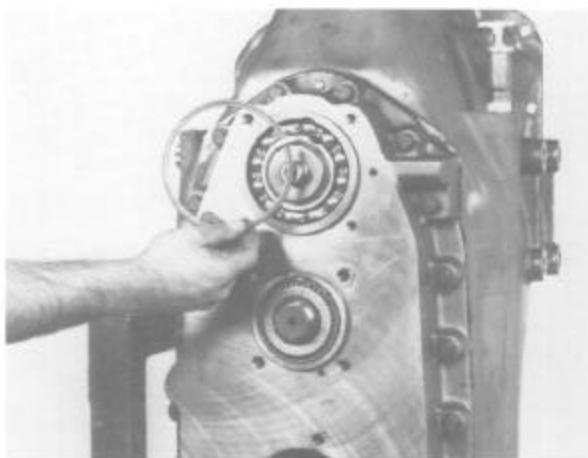


Figure 301

From the front, tap the 1st and 2nd clutch to the rear until the rear bearing locating ring groove is exposed. Install locating ring.

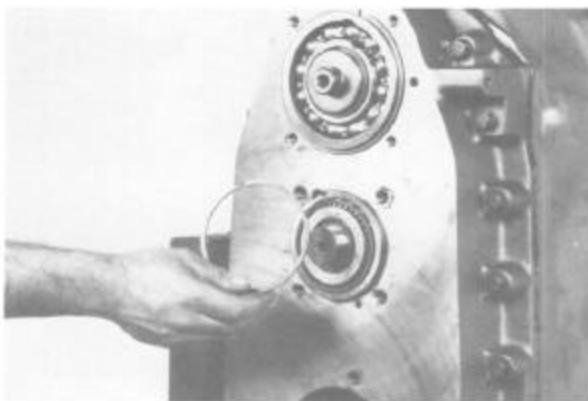


Figure 302

Repeat procedure in Figure 301 for idler shaft.

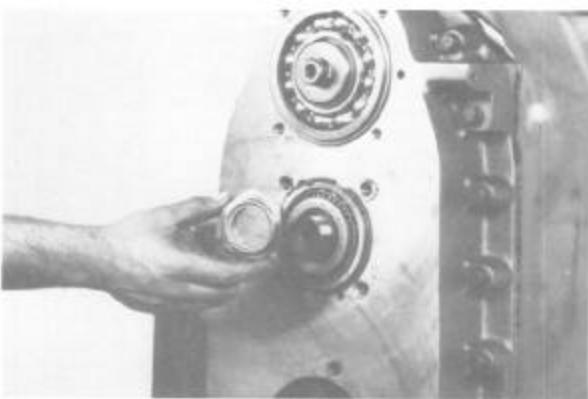


Figure 303

Install idler shaft rear bearing retainer nut. Tighten nut 200 to 250 ft. lbs. torque [271.2-338.9 N.m].

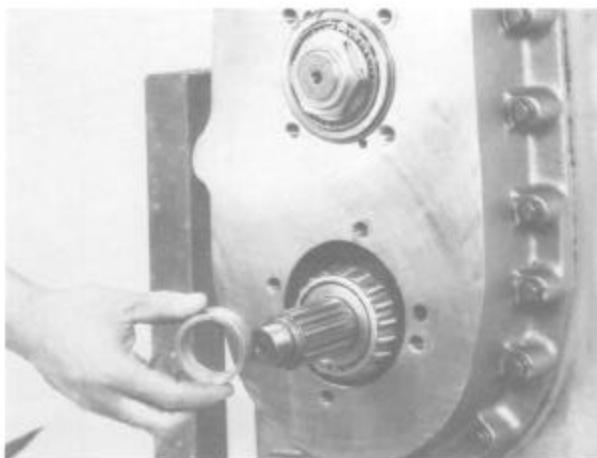


Figure 304

Position speedometer gear on output shaft. (Optional - not used on all models.)

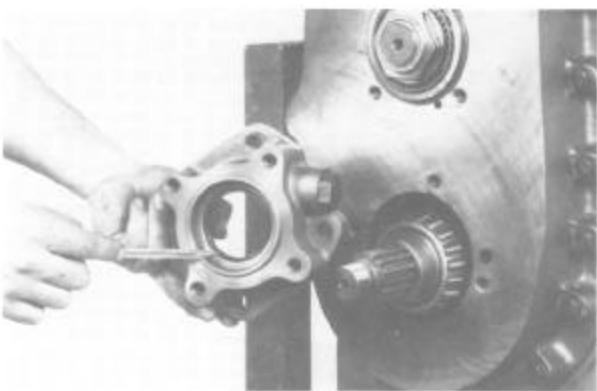


Figure 305

With rear taper bearing cup in rear bearing cap, apply a very light coat of Permatex #2 to the outer diameter of the rear output oil seal. Press seal in bearing cap with lip of seal in. With new "O" ring in position, install bearing cap.

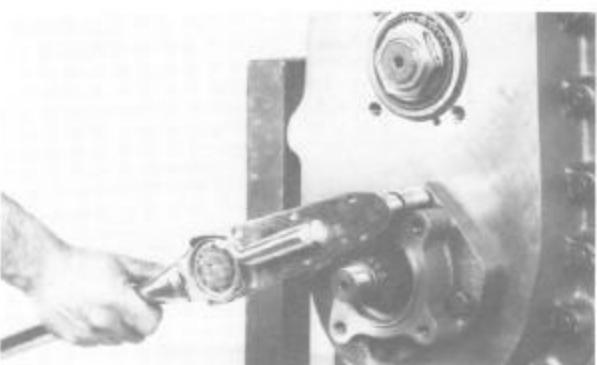


Figure 306

Install bolts and lockwashers and tighten to specified torque. (See torque chart.)

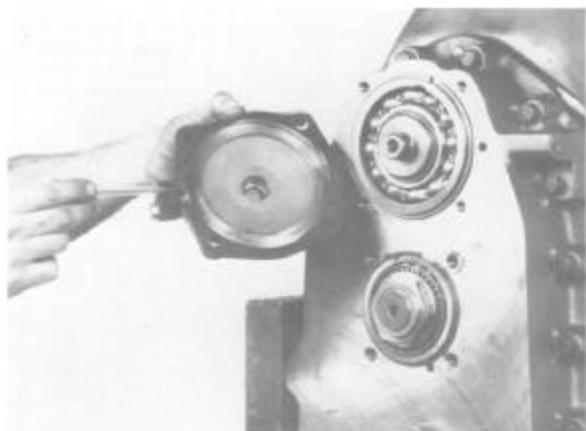


Figure 307

Position new "O" ring and gasket on 1st and 2nd clutch rear bearing cap.



Figure 308

Position bearing cap on clutch shaft. Install bolts and lockwashers, tighten to specified torque (See torque chart.)

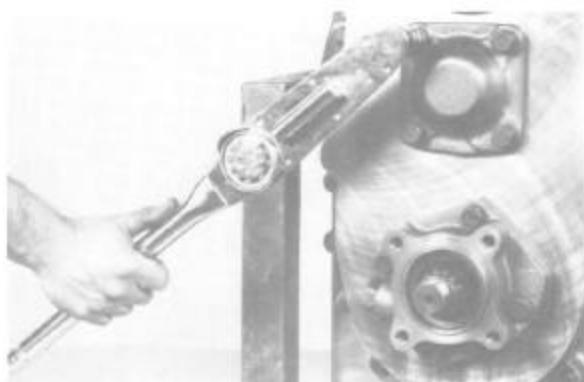


Figure 309

Position new gasket on idler shaft bearing cap. Install bearing cap, bolts and lockwashers, tighten to specified torque (See torque chart.)

#### OUTPUT SHAFT ROLLING TORQUE PROCEDURE (Bearing Preload)

Tap output shaft front and rear to seat taper bearings. Loosen front bearing cap bolts. Using an inch lb. torque wrench, determine the rolling torque of the output shaft and record. Tighten front bearing cap bolts to specified torque. Check rolling torque with bolts tight. Torque must be 6 to 8 inch lbs. [0.68-0.90 N.m] more than when bearing cap bolts were loose. Add or omit shims on the front bearing cap to achieve the proper preload.

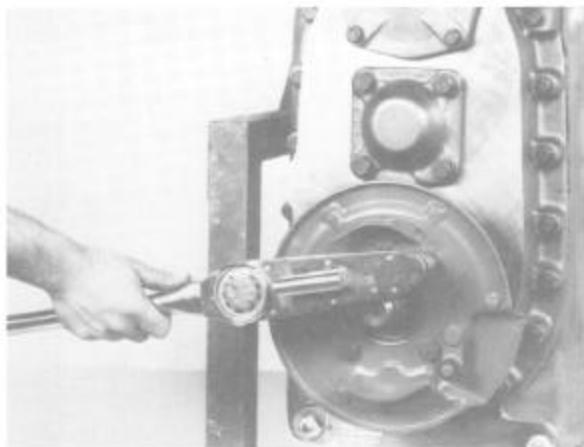


Figure 310

Position parking brake backing plate on output rear bearing cap. Install bolts and lockwashers, tighten to specified torque. (See torque chart)

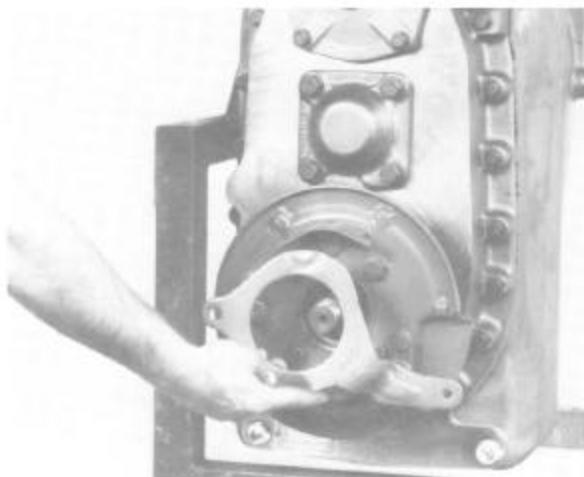
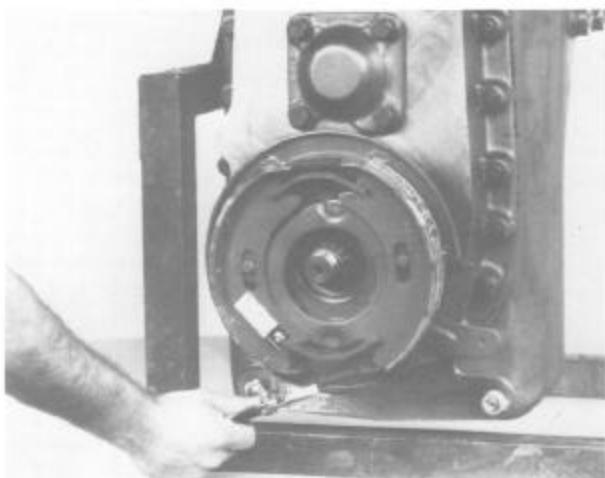


Figure 311

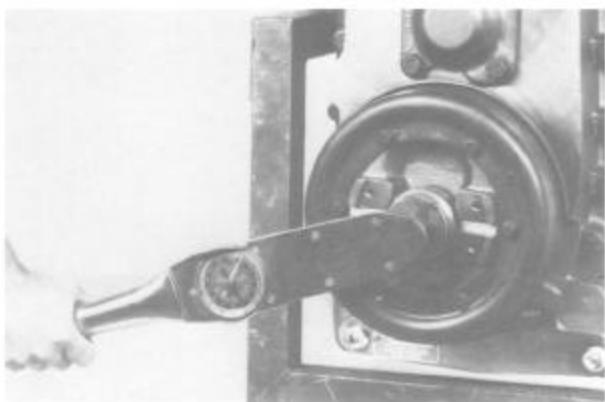
Position brake actuating arm.

**Figure 312**

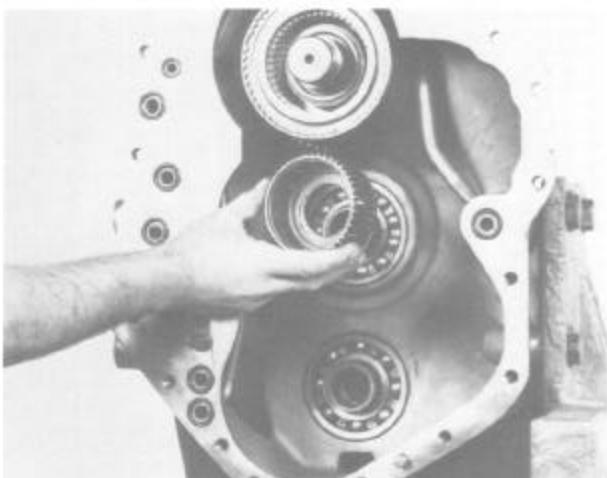
Locate brake shoes and linings on backing plate. Install upper and lower brake shoe return springs. Install brake drum and output flange.

**Figure 313**

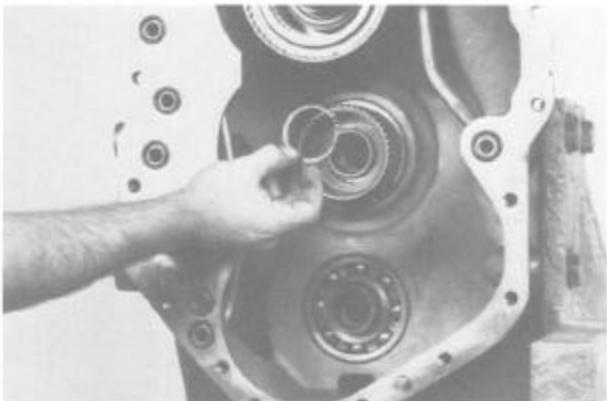
Install output flange "O" ring, washer and nut.

**Figure 314**

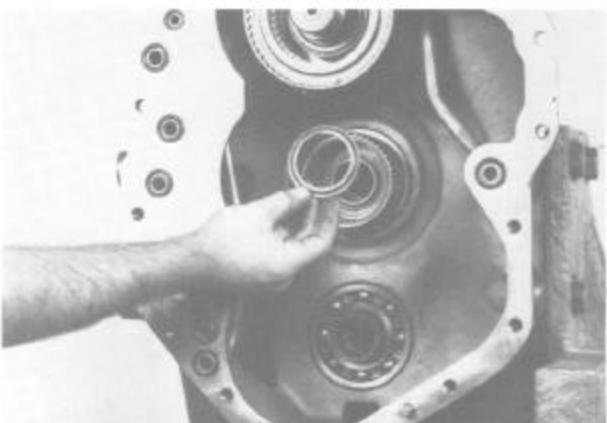
Tighten output flange nut 200 to 250 ft. lbs. torque [271.2-338.9 N.m].

**Figure 315**

Position 3rd and 4th speed clutch disc hub on 1st and 2nd clutch shaft.

**Figure 316**

Install disc hub retainer ring.

**Figure 317**

Install disc hub retainer ring retainer.

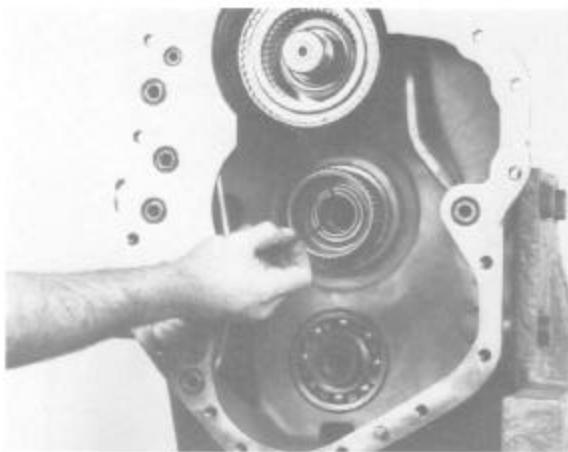


Figure 318  
Install ring retainer, retainer ring.

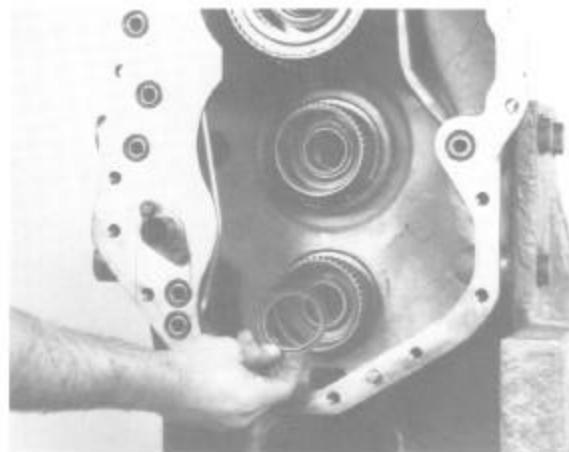


Figure 321  
Install disc hub retainer ring retainer.

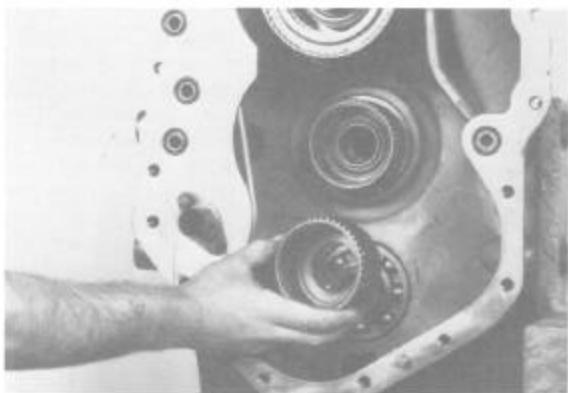


Figure 319  
Position 5th and 6th speed clutch disc hub on the idler shaft.

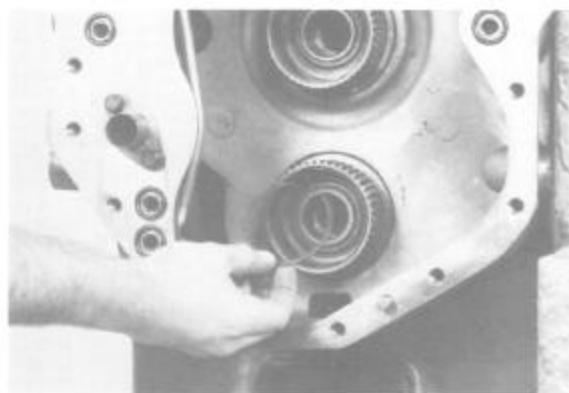


Figure 322  
Install ring retainer, retainer ring.



Figure 320  
Install disc hub retainer ring.

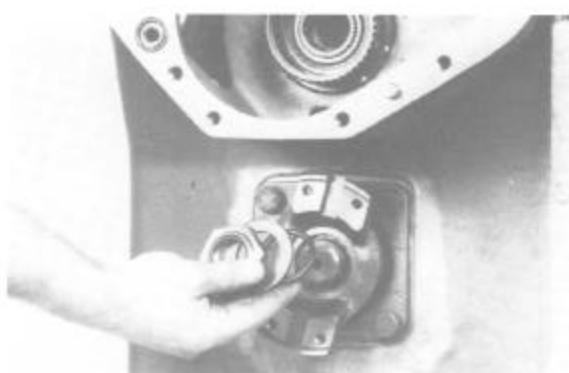


Figure 323  
Install the front output flange, "O" ring washer and nut.  
Tighten flange nut 200 to 250 ft. lbs. torque [271.2-338.9 N.m].



Figure 324  
Install forward clutch pilot bearing.

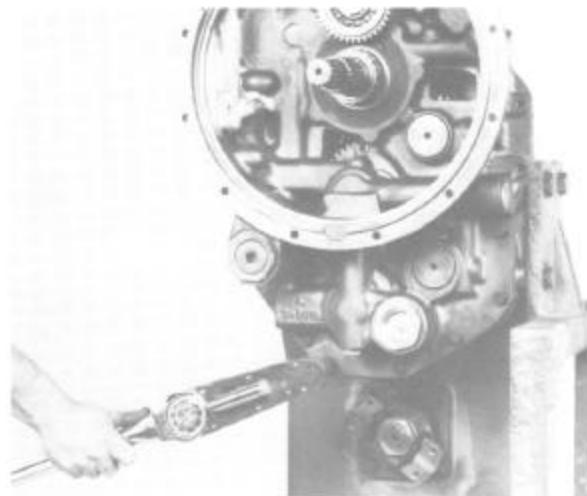


Figure 327

The use of two aligning studs will facilitate aligning the converter housing to the transmission housing. Install converter housing assembly to transmission assembly using extreme caution as to align the clutch pilots into the clutch disc hubs. As the clutch pilots enter the disc hubs turn the turbine shaft and output shaft back and forth. This will help align all of the clutch inner discs with the disc hubs. **DO NOT FORCE THIS OPERATION.** When all the clutches are properly aligned, the converter housing will be tight against the transmission housing. Install two housing to housing capscrews and lockwashers. Remove aligning studs. Install remaining capscrews and lockwashers. Tighten capscrews to specified torque. (See torque chart)

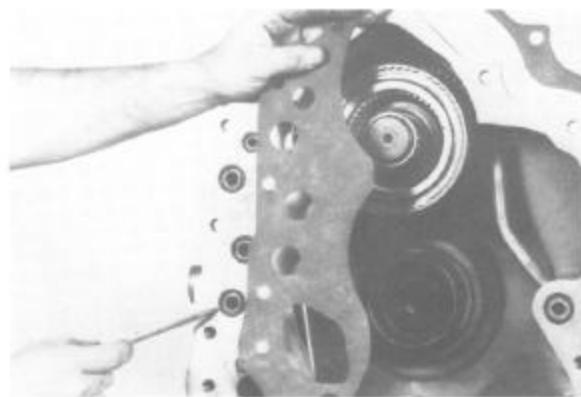


Figure 325  
Position new "O" rings and gasket on front of transmission housing. A light coat of chassis grease will hold "O" rings and gasket in place.

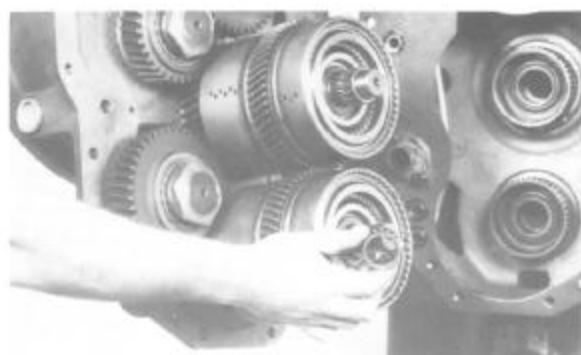


Figure 326  
Position pilot bearings on the 3rd and 4th & 5th & 6th clutch shafts, a light coat of grease will hold pilot bearings in place.



Figure 328  
Apply a light coat of Permatex #2 to the outer diameter of the oil baffle oil seal. Press seal in baffle with lip of seal toward impeller hub bearing. Position new oil baffle sealing ring on oil baffle. Position oil baffle in housing and install retaining ring. Be sure ring is in full position in ring groove.

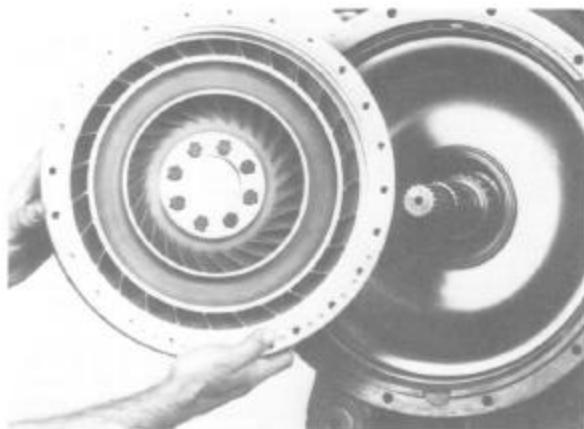


Figure 329

Install impeller and hub assembly using caution as not to damage the oil baffle oil seal. **NOTE:** Use extreme caution as not to cut, break or unhook the oil sealing ring on the support.



Figure 330

Position impeller hub bearing spacer on stator support.

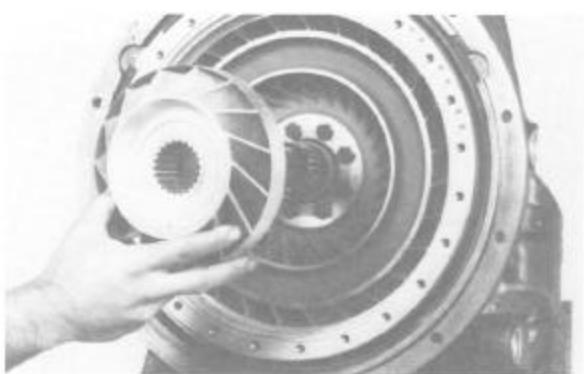


Figure 331

For a fixed reaction member, install reaction member with thick side of blades out.

For freewheel reaction member see Figure 333.

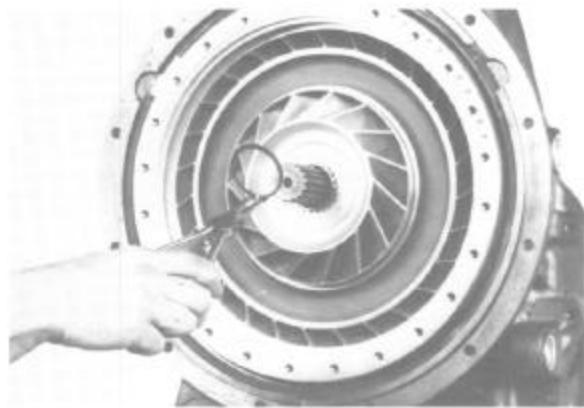


Figure 332

Install reaction member retainer ring. Proceed to Figure 337.

#### FREEWHEEL REASSEMBLY

**NOTE:** The freewheel assembly cannot be serviced. If the freewheel is damaged it must be replaced as an assembly.



Figure 333

Install outer race and sprag assembly in reaction member. **NOTE:** Undercut shoulder of race must go toward the rear of the reaction member.



Figure 334

Install outer race to reaction member retainer ring.

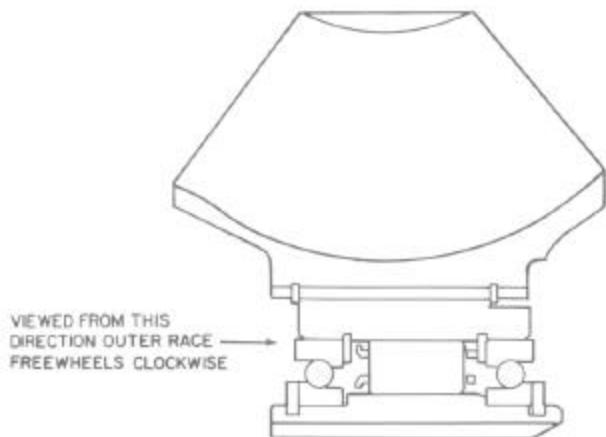


Figure 335

MUST FREEWHEEL IN  
CLOCKWISE ENGINE ROTATION



Figure 336

Position reaction member to impeller hub gear spacer on reaction member support. Install reaction member on support. Check rotation of freewheeling reaction member to be sure of proper freewheel assembly. Install reaction member retaining ring.

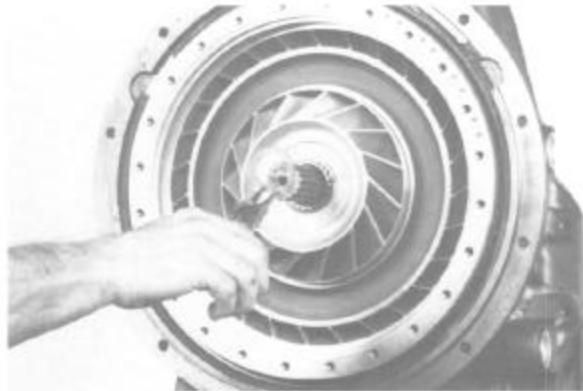


Figure 337

Install turbine locating ring.

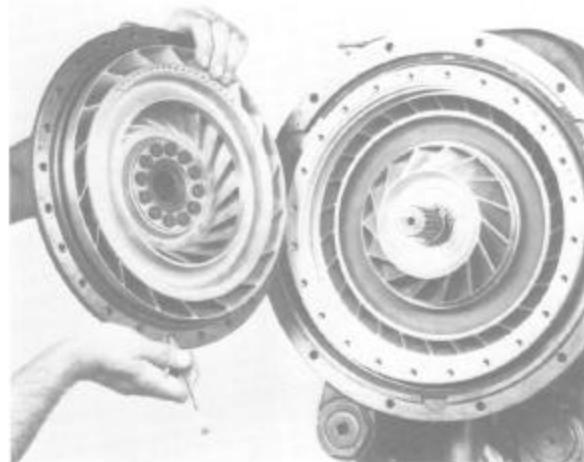


Figure 338

With a new impeller cover to impeller "O" ring in place, install turbine and impeller cover assembly on turbine shaft.

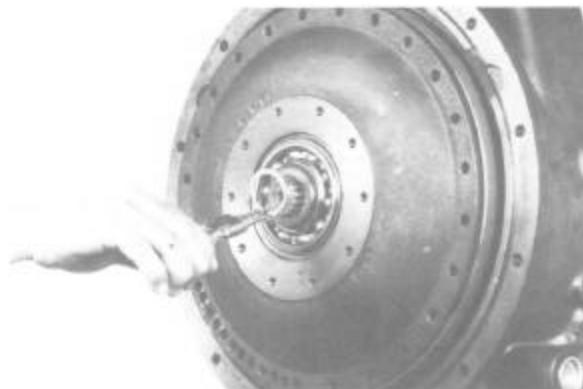


Figure 339

Install turbine hub to turbine shaft retainer ring.

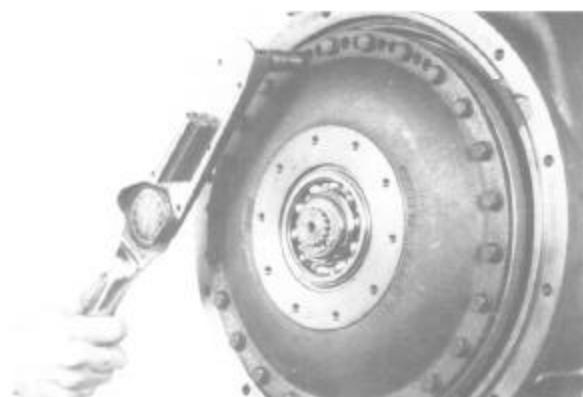


Figure 340

Install impeller cover to impeller screws and lockwashers. Tighten to specified torque. (See torque chart)

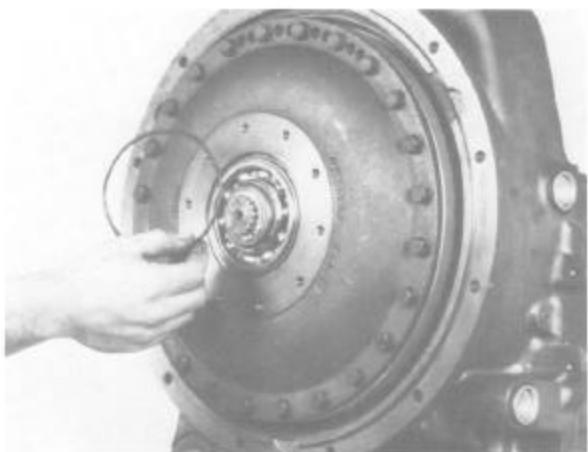


Figure 341

Position a new "O" ring over impeller cover bearing.

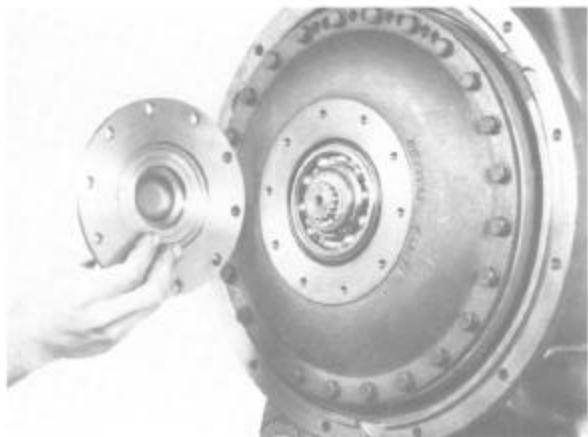


Figure 342

Position the impeller cover bearing cap on bearing.

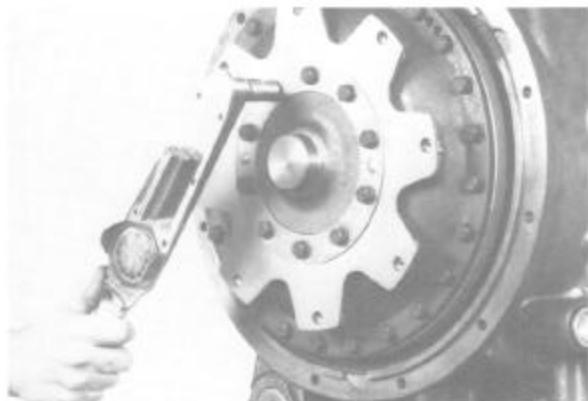


Figure 343

See special section on page 75 for drive plate installation.

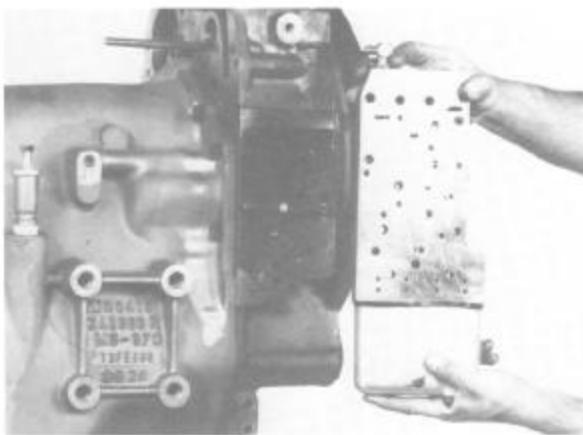


Figure 344

To install the control valve assembly it is recommended two aligning studs be used. Position new control valve to housing gasket on housing. Install control valve assembly.

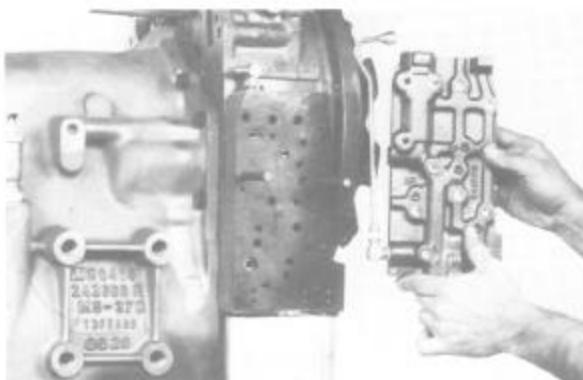


Figure 345

Position new shuttle valve gasket on control valve. Install shuttle valve assembly on control valve.

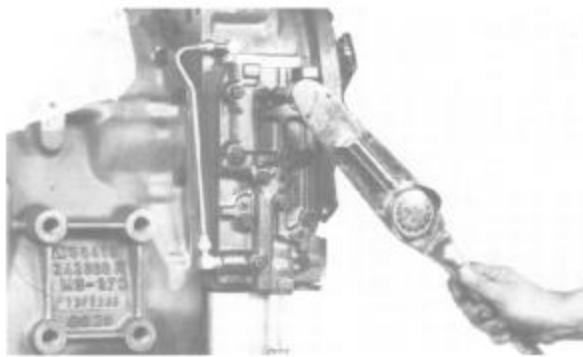


Figure 346

Install control valve to housing screws and lockwashers.  
NOTE: Use Loctite #262 on upper right hand screw.  
Tighten screws to specified torque. (See torque chart).

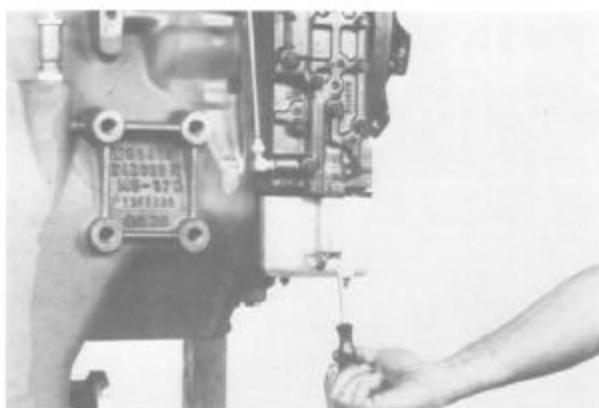


Figure 347

Connect the pressure line from the shuttle valve to the control valve. Connect the wires from the control valve to the shuttle valve solenoid.

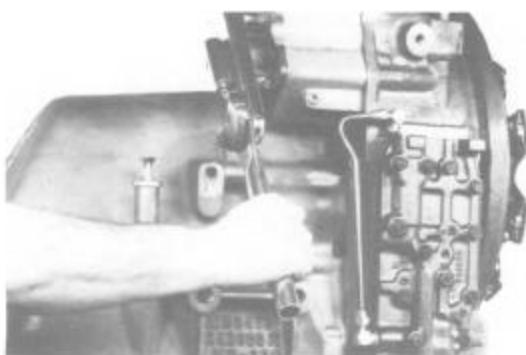


Figure 348

Using a new gasket, position charging pump assembly on mounting studs. Install washers, nuts and capscrews. Tighten nuts and capscrews to proper torque. (See torque chart.)

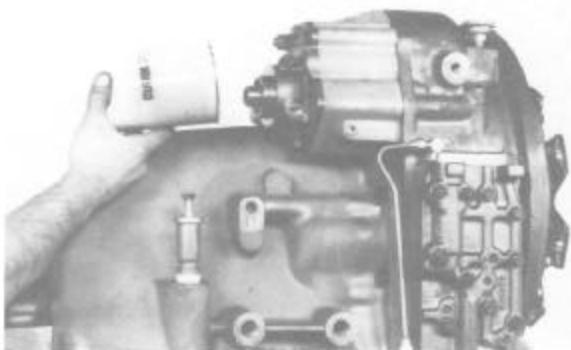


Figure 349

Install new oil filter cartridge. **NOTE:** It is recommended that the filter cartridge be changed after 50 and 100 hours of operation on new and rebuilt or repaired units.

The following is the disassembly and reassembly of the auxiliary pump drive and pump drive disconnect. Although the converter housing shown is different than the 6 speed full power shift converter housing the disassembly and reassembly procedure is the same.

#### DISASSEMBLY



Figure 350

Remove auxiliary pump drive idler gear support bolts.



Figure 351

Remove idler gear, pump drive gear, bearing and support as an assembly.



Figure 352

Remove pump drive gear bolts.

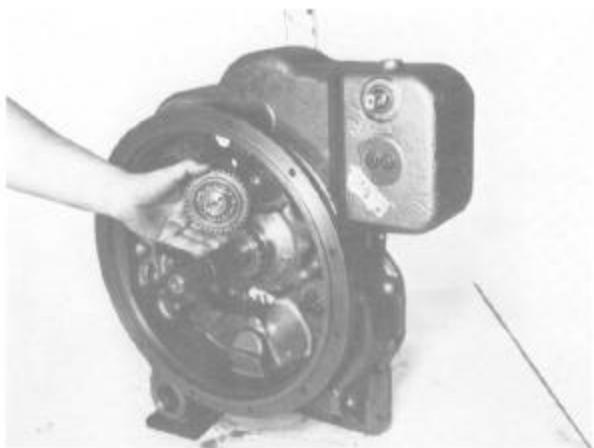


Figure 353  
Remove gear, bearing and support.

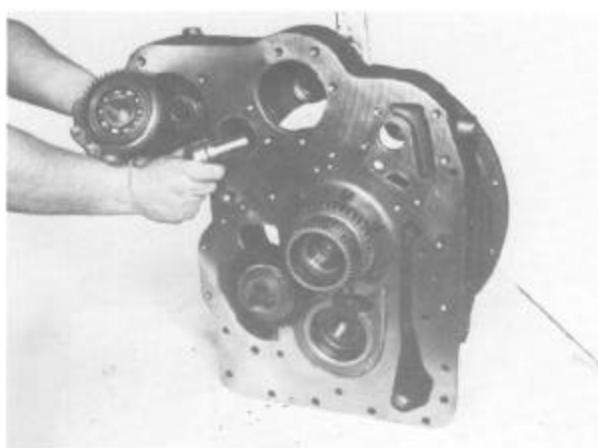


Figure 356  
Idler shaft and gear removed.

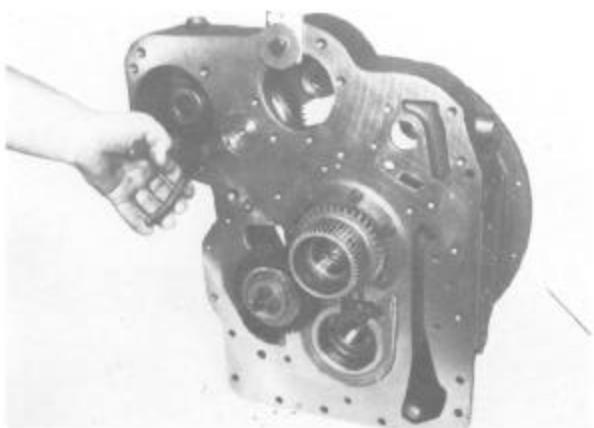


Figure 354  
Remove idler shaft retaining ring.

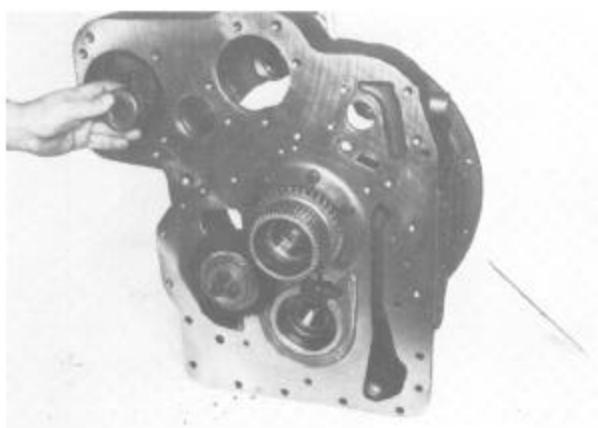


Figure 357  
Remove disconnect shift hub.

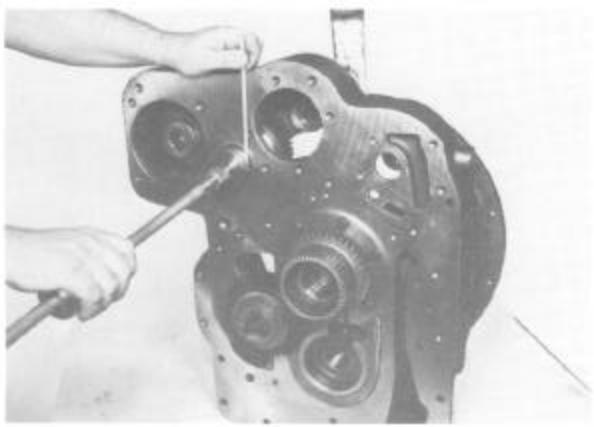


Figure 355  
Using a hammer puller as shown, remove idler shaft. **NOTE:**  
Use caution as not to lose shaft lock ball.

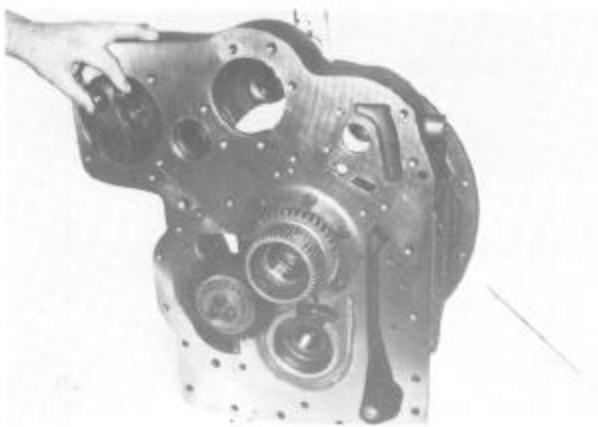


Figure 358  
Remove lock wire from shift fork lock screw, loosen lock screw and remove shift fork.

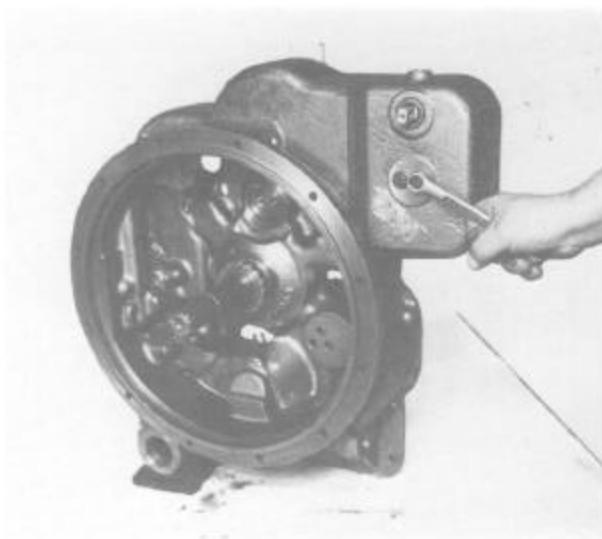


Figure 359

Remove pump drive gear support bolts.

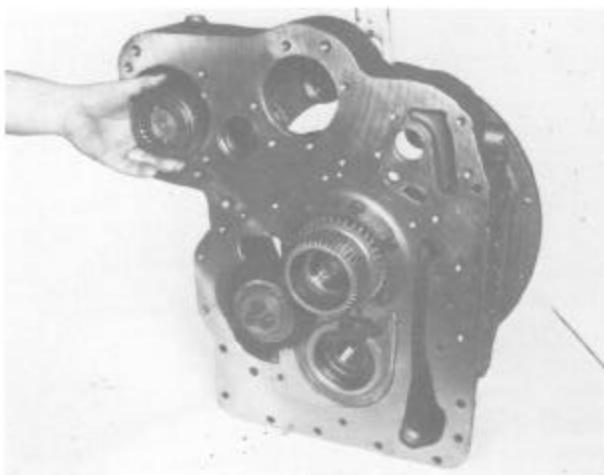


Figure 360

Remove pump drive gear, support and bearing assembly.

Remove shift rail detent plug, washer, spring and ball.

Remove shift rail and shift rail oil seal.

See cleaning and inspection page.



Figure 361

Position pump drive gear, bearings and support in housing. Align holes in bearing support with holes in housing. Install a flat washer on each support bolt. Install a sealing washer on each support bolt. Install bolts and washers thru the housing and into bearing support.

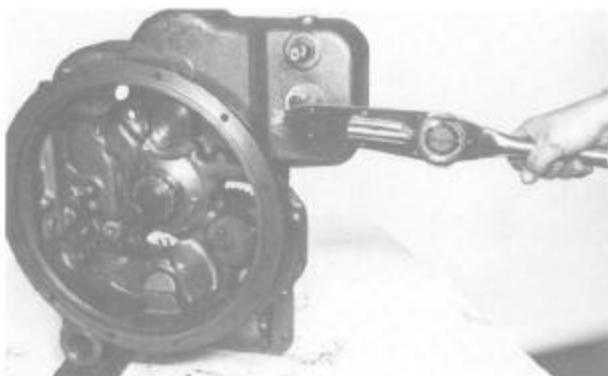


Figure 362

Tighten bearing support bolts 23 to 25 ft. lbs. torque [31.2-33.8 N.m].

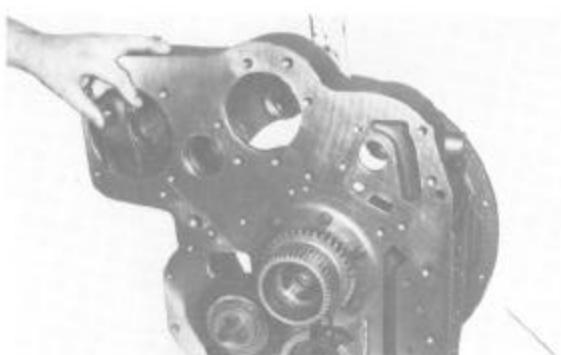


Figure 363

Position shift fork on shift rail with long hub of fork toward pump opening. Tighten fork to rail lock screw securely and lockwire to prevent loosening.

## REASSEMBLY

Apply a light coat of permatex # 2 to the outer diameter of the pump disconnect shift rail oil seal, install seal in housing with lip of seal in.

Install shift rail in housing. **NOTE:** Notches in shift rail must line up with detent hole on top of housing.

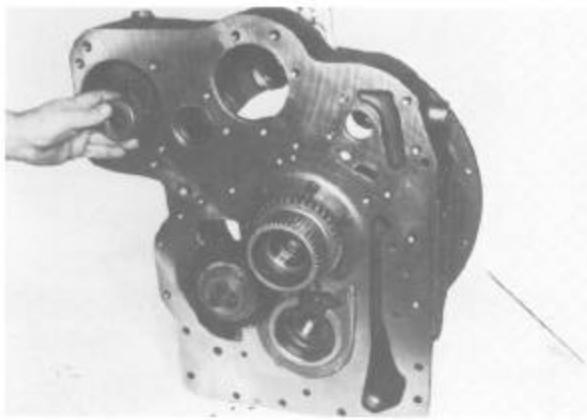


Figure 364

Position shift hub in shift fork with hub gear teeth toward pump drive gear. Shift hub into gear to hold hub in position.

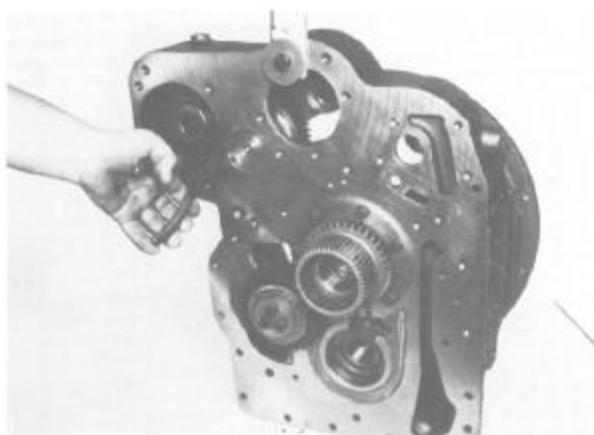


Figure 367

Install idler shaft retainer ring.



Figure 365

Install a new "O" ring on the pump drive idler shaft. Position lock ball in shaft. **NOTE:** A light coat of chassis grease will hold ball in shaft.



Figure 368

Position pump drive idler gear, drive gear and bearing assembly in housing.



Figure 366

From the front side (converter section) install pump drive idler gear and bearing assembly. Align idler shaft lock ball with notch in housing. Tap idler shaft, "O" ring and lock ball into housing and thru idler gear and bearing until idler shaft snap ring groove is exposed.

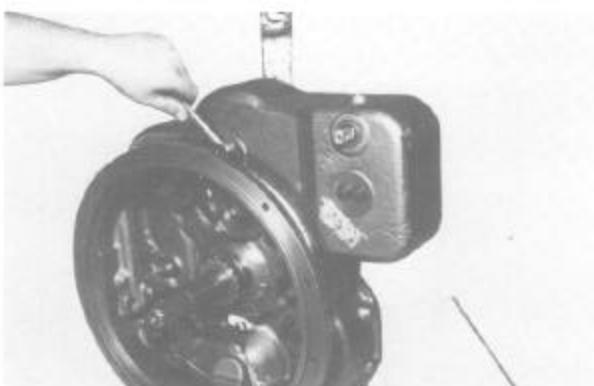


Figure 369

Install a flat washer on each support bolt. Install a sealing washer on each support bolt. Align pump drive bearing support holes with holes in housing. Install bolts and washers thru the housing and into the bearing support. Tighten 23 to 25 ft. lbs. torque [31.2-33.8 N.m].



Figure 370

Position pump drive gear, support and bearing assembly in converter housing.

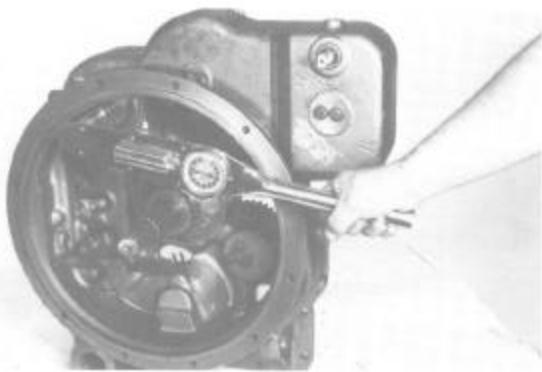


Figure 371

Align pump drive gear support holes with holes in converter housing, install support screws and lockwashers. Tighten 23 to 25 ft. lbs. torque [31.2-33.8 N.m]. Proceed with converter housing assembly.

#### OIL SEALING RING SLEEVE REMOVAL

NOTE: The following photos are not of the HR Converter Housing but the sleeve removal procedure is identical.

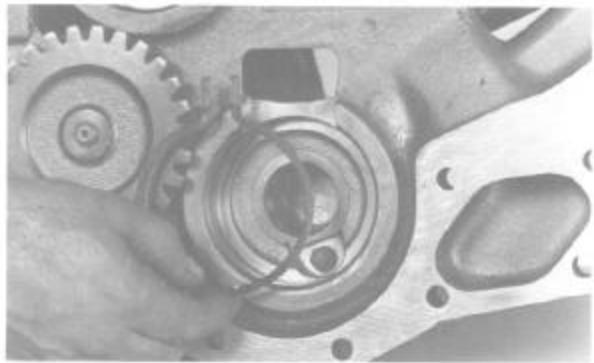


Figure 372

Remove clutch front bearing retaining ring.

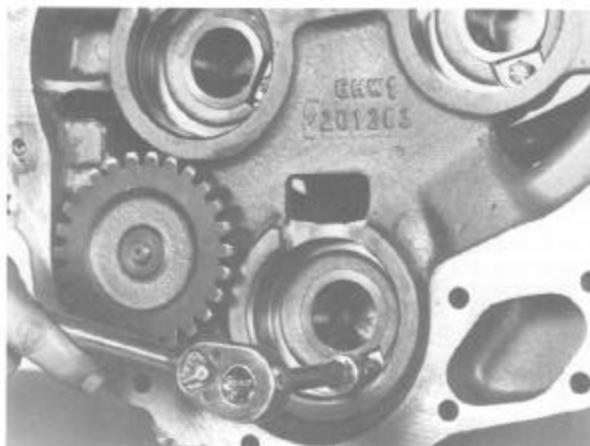


Figure 373

Remove front oil sealing ring sleeve retainer screw and washer. Remove sleeve lock.



Figure 374

Using a sleeve puller like the one shown, remove sleeve.

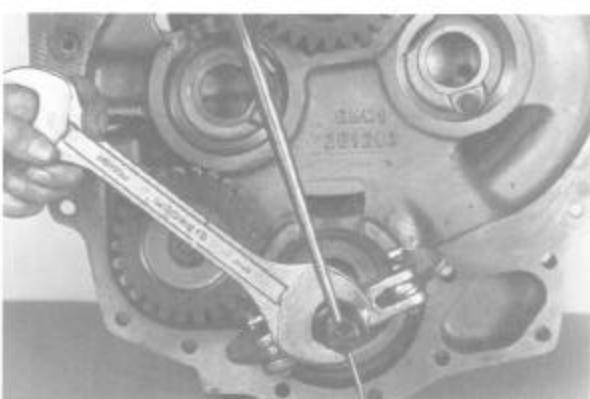


Figure 375

Sleeve being removed.

NOTE: When installing a new sleeve it is recommended a press or a driver be used to prevent damage to the sleeve and be sure the notch in the sleeve is aligned with sleeve lock notch.

## CLEANING AND INSPECTION

### CLEANING

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and moved up and down slowly until all old lubricant and foreign material is dissolved and parts are thoroughly cleaned.

**CAUTION:** Care should be exercised to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.

### Bearings

Remove bearings from cleaning fluid and strike larger side of cone flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisture free compressed air. Be careful to direct air stream across bearing to avoid spinning. Do not spin bearings when drying. Bearings may be rotated slowly by hand to facilitate drying process.

### Housings

Clean interior and exterior of housings, bearing caps, etc., thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

**CAUTION:** Care should be exercised to avoid skin rashes and inhalation of vapors when using alkali cleaners.

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rags free of abrasive materials such as metal filings, contaminated oil or lapping compound.

## INSPECTION

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

### Bearings

Carefully inspect all rollers, cages and cups for wear, chipping or nicks to determine fitness of bearings for further use. Do not replace a bearing cone or cup individually without replacing the mating cup or cone at the same time. After inspection, dip bearings in clean light oil and wrap in clean lintless cloth or paper to protect them until installed.

### Oil Seals, Gaskets and Retaining Rings

Replacement of spring load oil seals, "O" rings, metal sealing rings, gaskets and snap rings is more economical when unit is disassembled than premature overhaul to replace these parts at a future time. Further loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency. Apply a thin coat of Permatex No.2 on the outer diameter of the oil seal to assure an oil tight fit into the retainer. When assembling new metal type sealing rings, same should be lubricated with coat of chassis grease to stabilize rings in their grooves for ease of assembly of mating members. Lubricate all "O" rings and seals with recommended type Automatic Transmission Fluid before assembly.

### Gears and Shafts

If magna-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks or scores. If gear teeth show spots where case hardening is worn through or cracked, replace with new gear. Small nicks may be removed with suitable hone. Inspect shafts and quills to make certain they are not sprung, bent, or splines twisted, and that shafts are true.

### Housing, Covers, etc.

Inspect housings, covers and bearing caps to be certain they are thoroughly cleaned and that mating surfaces, bearing bores, etc., are free from nicks or burrs. Check all parts carefully for evidence of cracks or condition which would cause subsequent oil leaks or failures.

## SERVICING MACHINE AFTER TRANSMISSION OVERHAUL

The transmission" torque converter, and its allied hydraulic system are important links in the drive line between the engine and the wheels. The proper operation of either unit depends greatly on the condition and operation of the other; therefore, whenever repair or overhaul of one unit is performed, the balance of the system must be considered before the job can be considered completed.

After the overhauled or repaired transmission has been installed in the machine, the oil cooler, and connecting hydraulic system must be thoroughly cleaned. This can be accomplished in several manners and a degree of judgment must be exercised as to the method employed,

The following are considered the minimum steps to be taken:

1. Drain engine system thoroughly.
2. Disconnect and clean all hydraulic lines. Where feasible, hydraulic lines should be removed from machine for cleaning.
3. Replace oil filter elements, cleaning out filter cases thoroughly.
4. The oil cooler must be thoroughly cleaned. The cooler should be "back flushed" with oil and compressed air until all foreign material has been removed. Flushing in direction of normal oil flow will not adequately clean the cooler. If necessary, cooler assembly should be removed from

machine for cleaning, using oil, compressed air and steam cleaner for that purpose. DO NOT use flushing compounds for cleaning purposes.

5. On remote mounted torque converters remove drain plug from torque converter and inspect interior of converter housing, gears, etc. If presence of considerable foreign material is noted, it will be necessary that converter be removed, disassembled and cleaned thoroughly. It is realized this entails extra labor; however, such labor is a minor cost compared to cost of difficulties which can result from presence of such foreign material in the system.
6. Reassemble all components and use only type oil recommended in lubrication section. Fill transmission through filler opening until fluid comes up to LOW mark on transmission dipstick.

Run engine two minutes at 500-600 RPM to prime torque converter and hydraulic lines. Recheck level of fluid in transmission with engine running at idle (500-600 RPM).

Add quantity necessary to bring fluid level to LOW mark on dipstick. Recheck with hot oil (180-200° F.) [82, 2-93, 3° C].

Bring oil level to FULL mark on dipstick.

7. Recheck all drain plugs, lines, connections, etc., for leaks and tighten where necessary.

## TOWING OR PUSH STARTING

Before towing the vehicle, be sure to lift the rear wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing.

NOTE: If the transmission has 4 wheel drive, disconnect both front and rear drivelines. Because of the design of the hydraulic system, the engine cannot be started by pushing or towing.

## SPECIFICATIONS AND SERVICE DATA-POWER SHIFT TRANSMISSION AND TORQUE CONVERTER

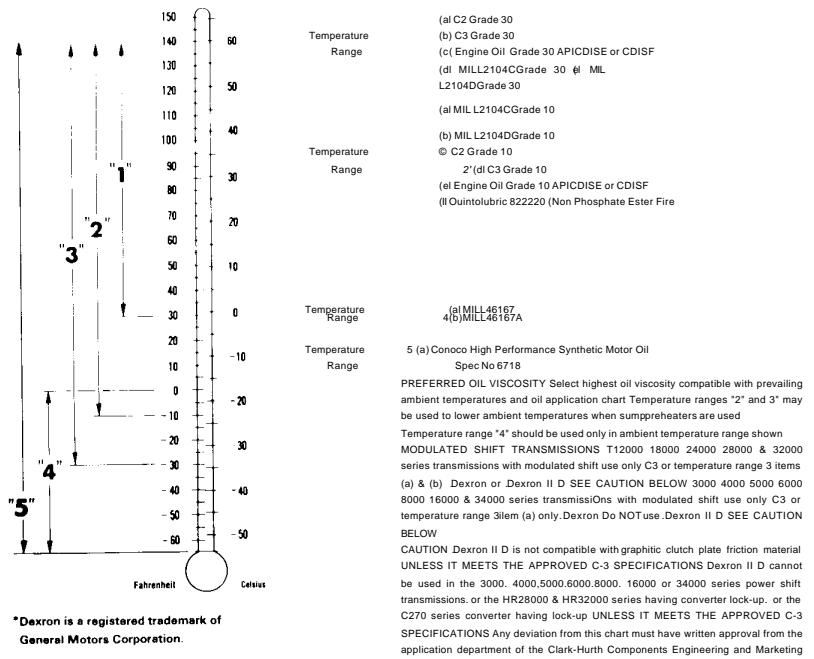
CONVERTER OUT PRESSURE	Converter outlet oil temp 180 ° - 200 ° F 182.3° 93.3° C] Transmission in NEUTRAL. Operating specifications 25 PS. 1172.4 kPa minimum pressure at 2000 RPM engine speed AND a maximum of 70 PSI [482.6 kPa] outlet pressure with engine operating at no load governed speed	OIL FIL TRATION	Full flow oil filter safety by-pass, also strainer screen in sump at bottom of transmission case
CONTROLS	Forward and Reverse Manual Speed Selection Manual	CLUTCH PRESSURE	240 - 300 psi [1654.8 - 2068.4 kPa] With parking brake set (see note), oil temperature 180 ° 182.2° 93.3°C], engine at idle 1400 to 600 RPM, shift thru direction and speed clutches All clutch pressure must be equal within 5 psi 134.5 kPa]. If clutch pressure varies in any one clutch more than 5 psi 134.5 kPa repair clutch
CLUTCH TYPE	Multiple discs, hydraulically actuated, spring released automatic wear compensation and no adjustment. All clutches oil cooled and lubricated		NOTE: Never use service brakes while making clutch pressure checks. Units having brake actuated declutching in forward and/or reverse will not give a true reading
CLUTCH INNER DISC	Friction		ALWAYS USE PARKING BRAKE WHEN MAKING CLUTCH PRESSURE CHECKS
CLUTCH OUTER DISC	Steel.		

## LUBRICATION

### RECOMMENDED LUBRICANTS FOR CLARK-HURTH COMPONENTS POWER SHIFTED TRANSMISSION AND TORQUE CONVERTERS

Prevailing Ambient Temperature

TYPE OF OIL	See Lube Chart.
CAPACITY	Consult Operator's Manual on applicable machine model for system capacity Torque Converter Transmission and allied hydraulic system must be considered as a whole to determine capacity
CHECK PERIOD	Check oil level DAILY with engine running at 500000 RPM and oil at 180° to 200° F 182.2 93.3 ° C. Maintain oil level to FULL Mark
NORMAL * DRAIN PERIOD	Every 500 hours, change oil filter element. Every 1000 hours, drain and refill system as follows Drain with oil at 150° to 200° F 165.6 -93.3 ° C].
	NOTE: It is recommended that filter elements be changed after 50 and 100 hours of operation on new and rebuilt or repaired units.
(a)	Drain transmission and remove sump screen. Clean screen thoroughly and replace, using new gaskets.
(b)	Drain oil filters, remove and discard filter elements. Clean filter shells and install new elements.
(c)	Refill transmission to LOW mark
(d)	Run engine at 500-600 RPM to prime converter and lines.
(e)	Recheck level with engine running at 500-600 RPM and add oil to bring level to LOW mark When oil temperature is hot 1180-200° F. (82.2-93.3 ° C) make final oil level check. BRING OIL LEVEL TO F'III MARK



\*Normal drain periods and filter change intervals are for average environmental and duty-cycle conditions. Severe or sustained high operating temperatures or very dusty atmospheric conditions will cause accelerated deterioration and contamination. For extreme conditions judgment must be used to determine the required change intervals.

**TROUBLE SHOOTING GUIDE**  
**For The**  
**R & H R Model, 24000 Transmission**

The following data is presented as an aid to locating the source of difficulty in a malfunctioning unit. It is necessary to consider the torque converter charging pump, transmission, oil cooler, and connecting lines as a complete system when running down the source of trouble since the proper operation of any unit therein depends greatly on the condition and operations of

the others. By studying the principles of operation together with data in this section, it may be possible to correct any malfunction which may occur in the system.

TROUBLE SHOOTING PROCEDURE BASICALLY CONSISTS OF TWO CLASSIFICATIONS: MECHANICAL AND HYDRAULIC.

**MECHANICAL CHECKS**

Prior to checking any part of the system from a hydraulic standpoint, the following mechanical checks should be made:

1. A check should be made to be sure all control lever linkage is properly connected and adjusted at all connecting points.

2. Check shift levers and rods for binding or restrictions in travel that would prevent full engagement. Shift levers by hand at control valve, if full engagement cannot be obtained, difficulty may be in control cover and valve assembly.

**HYDRAULIC CHECKS**

Before checking on the torque converter, transmission, and allied hydraulic system for pressures and rate of oil flow, it is essential that the following preliminary checks be made:

Check oil level in transmission. This should be done with oil temperatures of 180 to 200° F, [82.2-93.3° C], DO NOT ATTEMPT THESE CHECKS WITH COLD OIL. To bring the oil temperature to this specification it is necessary to either work the machine or "stall" out

the converter. Where the former means is impractical, the latter means should be employed as follows:

Engage shift levers in forward and high speed and apply brakes. Accelerate engine half to three-quarter throttle.

Hold stall until desired converter outlet temperature is reached. **CAUTION: FULL THROTTLE STALL SPEEDS FOR AN EXCESSIVE LENGTH OF TIME WILL OVERHEAT THE CONVERTER,**

**LOW CLUTCH PRESSURE**

**Cause**

1. Low oil level.
2. Clutch pressure regulating valve spool stuck open.
3. Faulty charging pump.
4. Broken or worn clutch shaft or piston sealing rings.
5. Clutch piston bleed valve stuck open.

**Remedy**

1. Fill to proper level.
2. Clean valve spool and housing.
3. Replace pump.
4. Replace sealing rings.
5. Clean bleed valves thoroughly.

**LOW CONVERTER CHARGING PUMP OUTPUT**

1. Low oil level.
2. Suction screen plugged.
3. Air leaks at pump intake hose and connections or collapsed hose. (R24000 only)
4. Defective oil pump.

1. Fill to proper level.
2. Clean suction screen.
3. Tighten all connections or replace hose if necessary.
4. Replace pump.

**OVERHEATING**

1. Worn oil sealing rings.
2. Worn oil pump.
3. Low oil level.
4. Pump suction line taking air. (R24000 only)

1. Remove" disassemble, and rebuild converter assembly.
2. Replace.
3. Fill to proper level..
4. Check oil line connections and tighten securely.

**NOISY CONVERTER**

1. Worn oil pump.
2. Worn or damaged bearings.

1. Replace.
2. A complete disassembly will be necessary to determine what bearing is faulty.

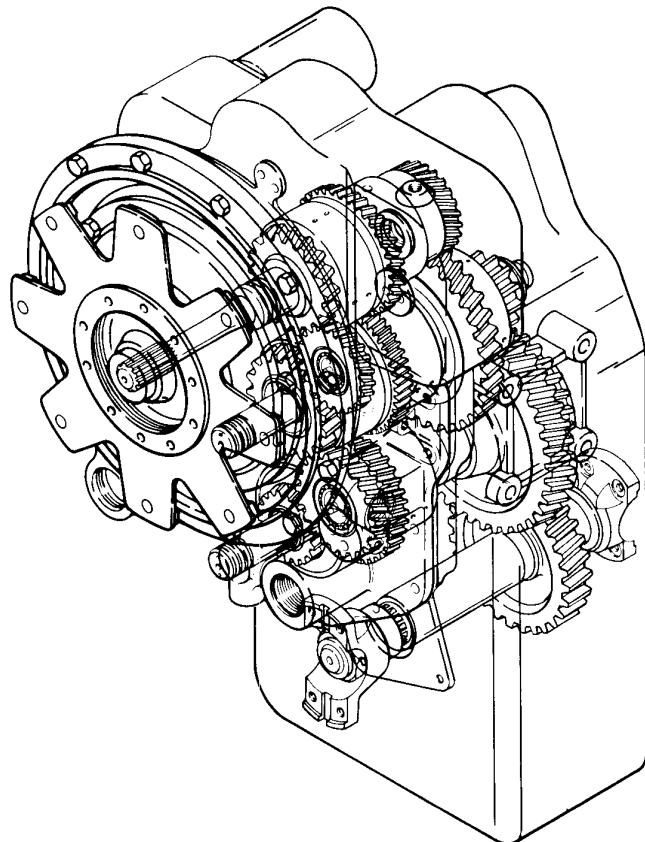
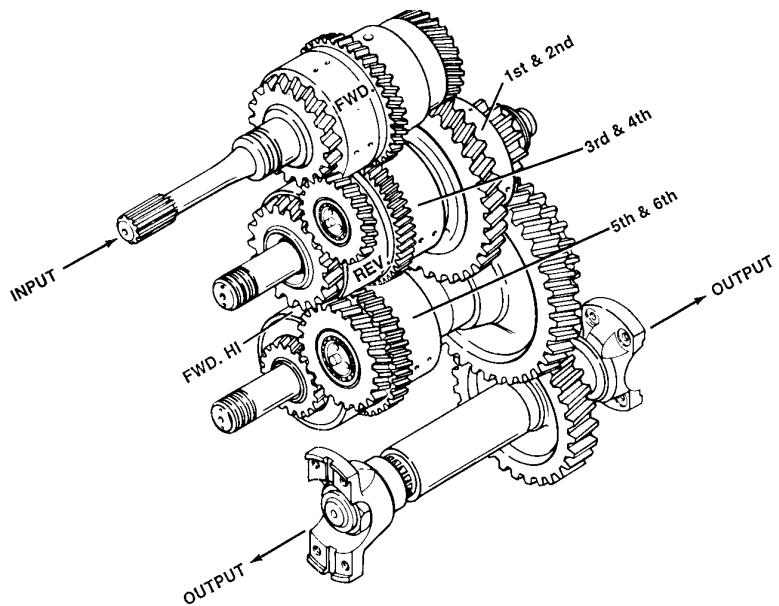
**LACK OF POWER**

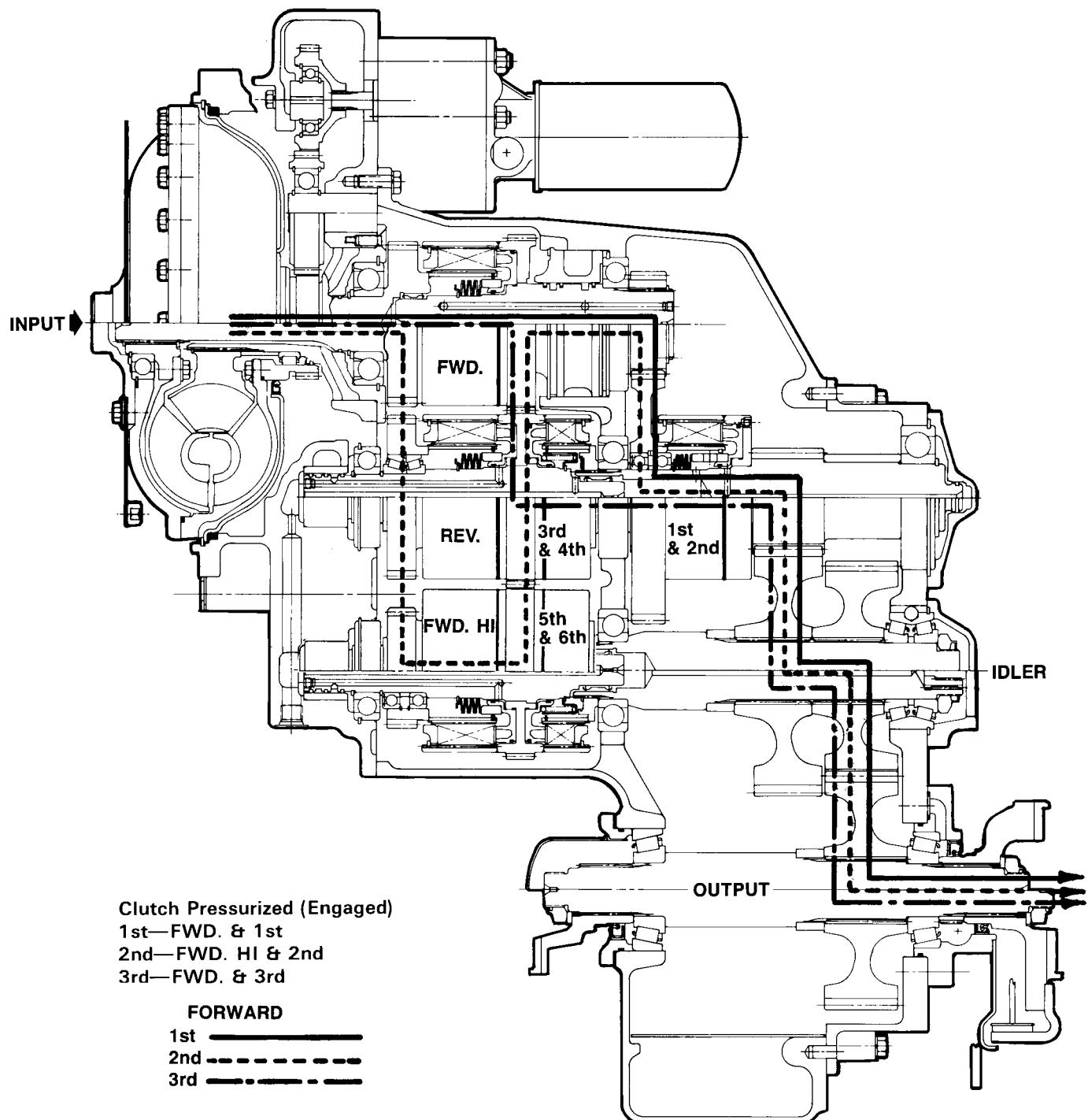
- 1, Low engine RPM at converter stall,
2. See "Overheating" and make same checks.

- 1, Tune engine check governor,
2. Make corrections as explained in "Overheating."

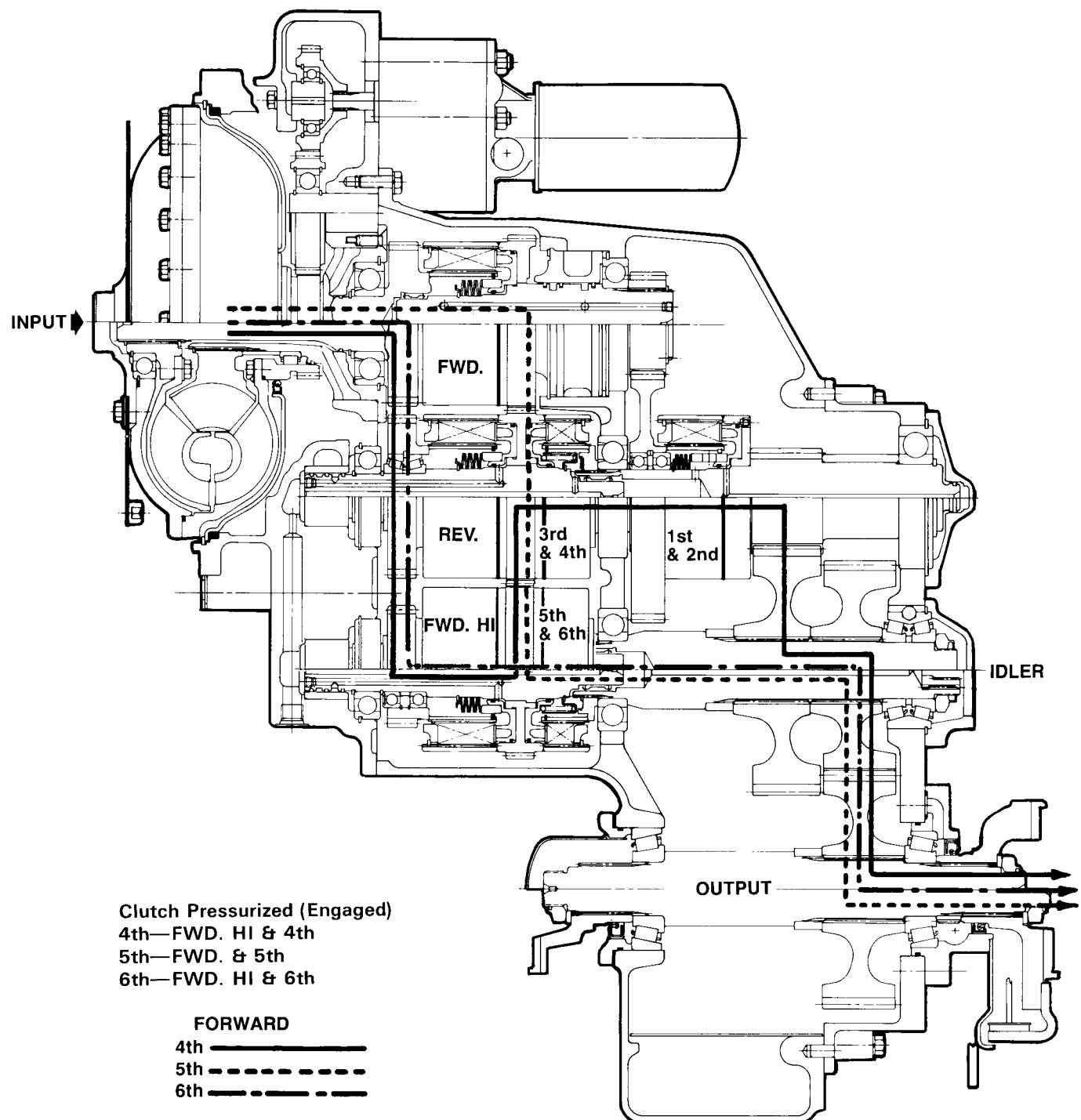
## 24000 SERIES 6 SPEED FULL POWERSHIFT CLUTCH

## AND GEAR ARRANGEMENT

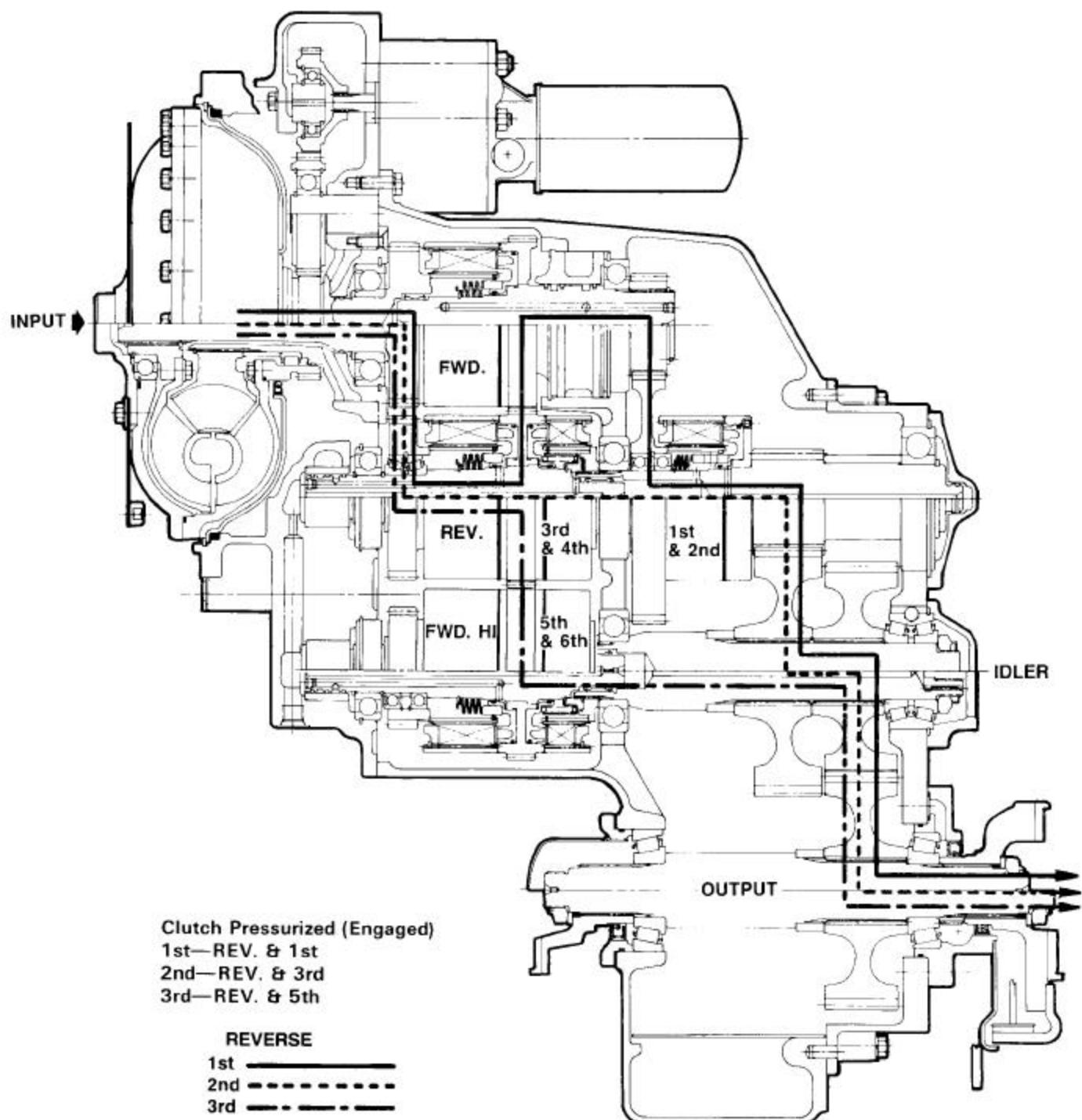




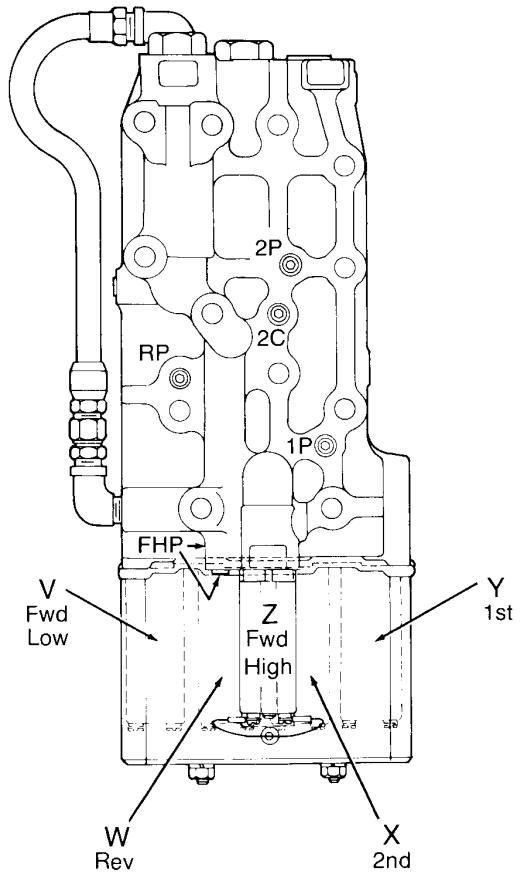
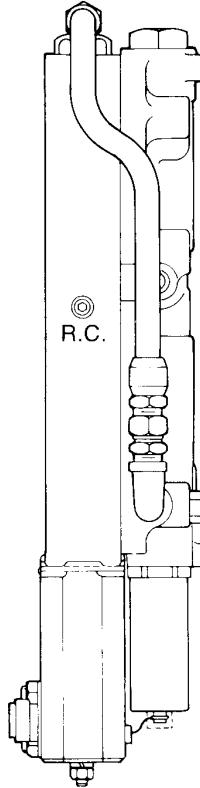
HR 24000 -6 SPEED TRANSMISSION



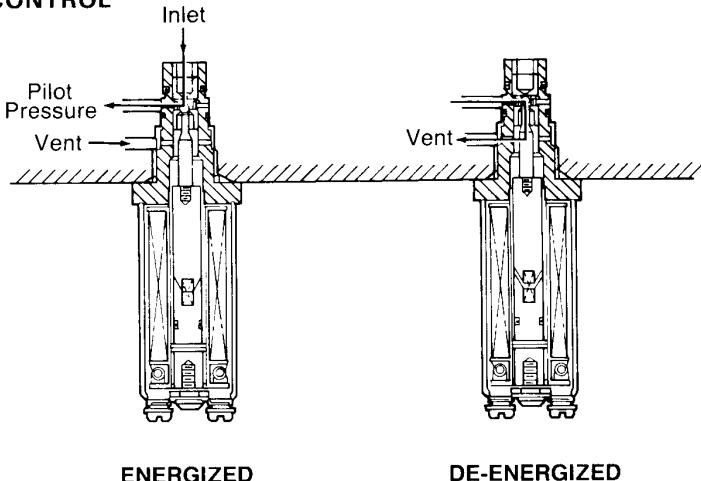
HR 24000 -6 SPEED TRANSMISSION



HR 24000 -6 SPEED TRANSMISSION



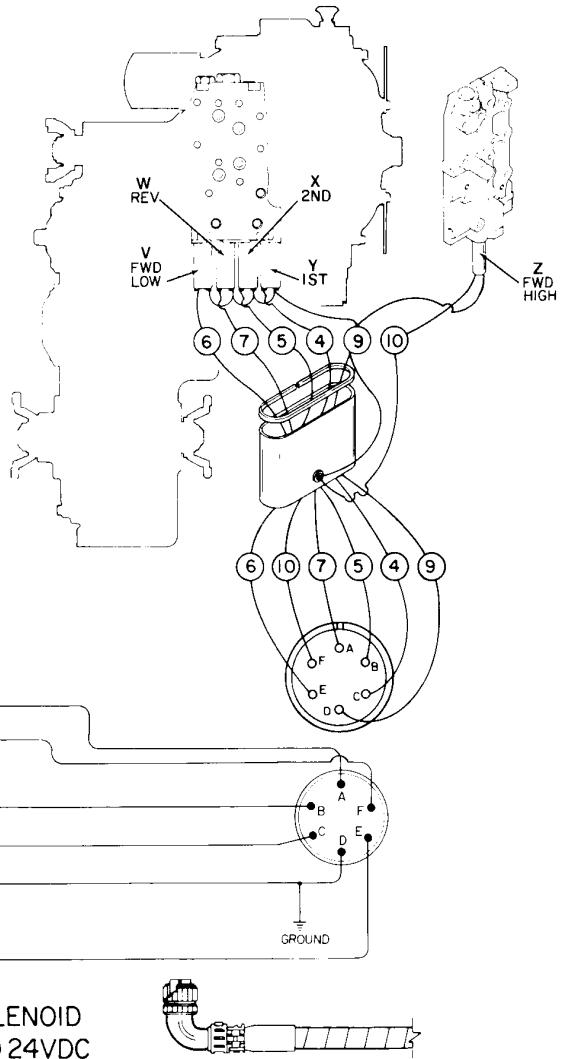
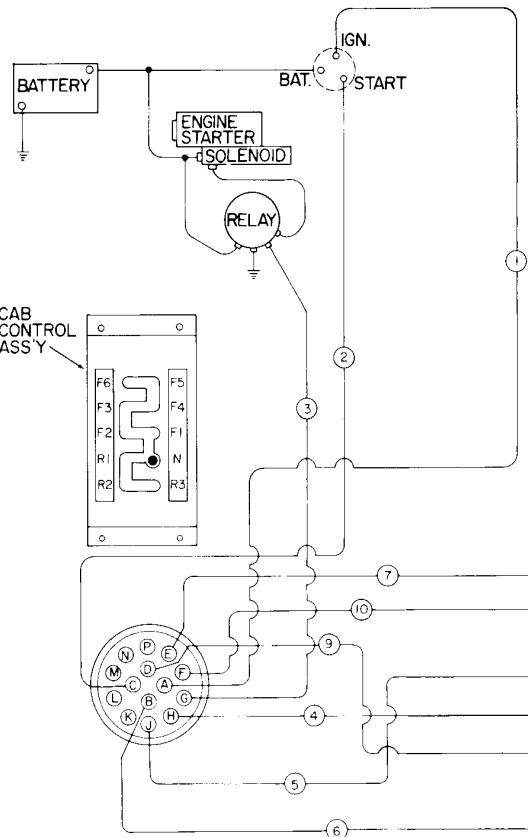
### 6 SPEED TRANSMISSION ELECTRIC SOLENOID CONTROL



DIRECTION & SPEED	SOLENOIDS ENERGIZED	CLUTCHES PRESSURIZED
Forward 1st	V X Y	Forward & 1st
Forward 2nd	V X Y Z	Fwd. High & 1st
Forward 3rd	V X	Fwd. & 2nd
Forward 4th	V X Z	Fwd. High & 2nd
Forward 5th	V	Fwd. & 3rd
Forward 6th	V Z	Fwd. High & 3rd
Reverse 1st	W X Y	Rev. & 1st
Reverse 2nd	W X	Rev. & 2nd
Reverse 3rd	W	Rev. & 3rd

#### PILOT & CLUTCH PRESSURE CHECK POINTS

1P 1st Pilot  
 2P 2nd Pilot  
 2C 2nd Clutch  
 FHP Fwd High Pilot  
 R.P. Reverse Pilot  
 R.C. Reverse Clutch

6 SPD. TRANSMISSION ELECTRIC SOLENOID  
CONTROL WIRING DIAGRAM - 12VDC AND 24VDC

## NOTE:

USE RELAY WHERE STARTER SOLENOID  
DRAW IS MORE THAN 6AMPS

## RELAY NO.

DELCO-REMY 1114238DR-12VDC OR EQUIV.  
DELCO-REMY 1114239DR-24VDC OR EQUIV.

CAB CONTROL IS SUPPLIED WITH 36INCHES  
OF LEAD WIRE - BLANK ENDS.

WIRE SIZE :-  
NO.18 A.W.G.

## CAB CONTROL

WIRE NO.	COLOR CODE
1	WHITE
2	BLACK
3	RED
4	YELLOW
5	GREEN
6	BLUE
7	BROWN
8	BLACK
9	ORANGE
10	PINK

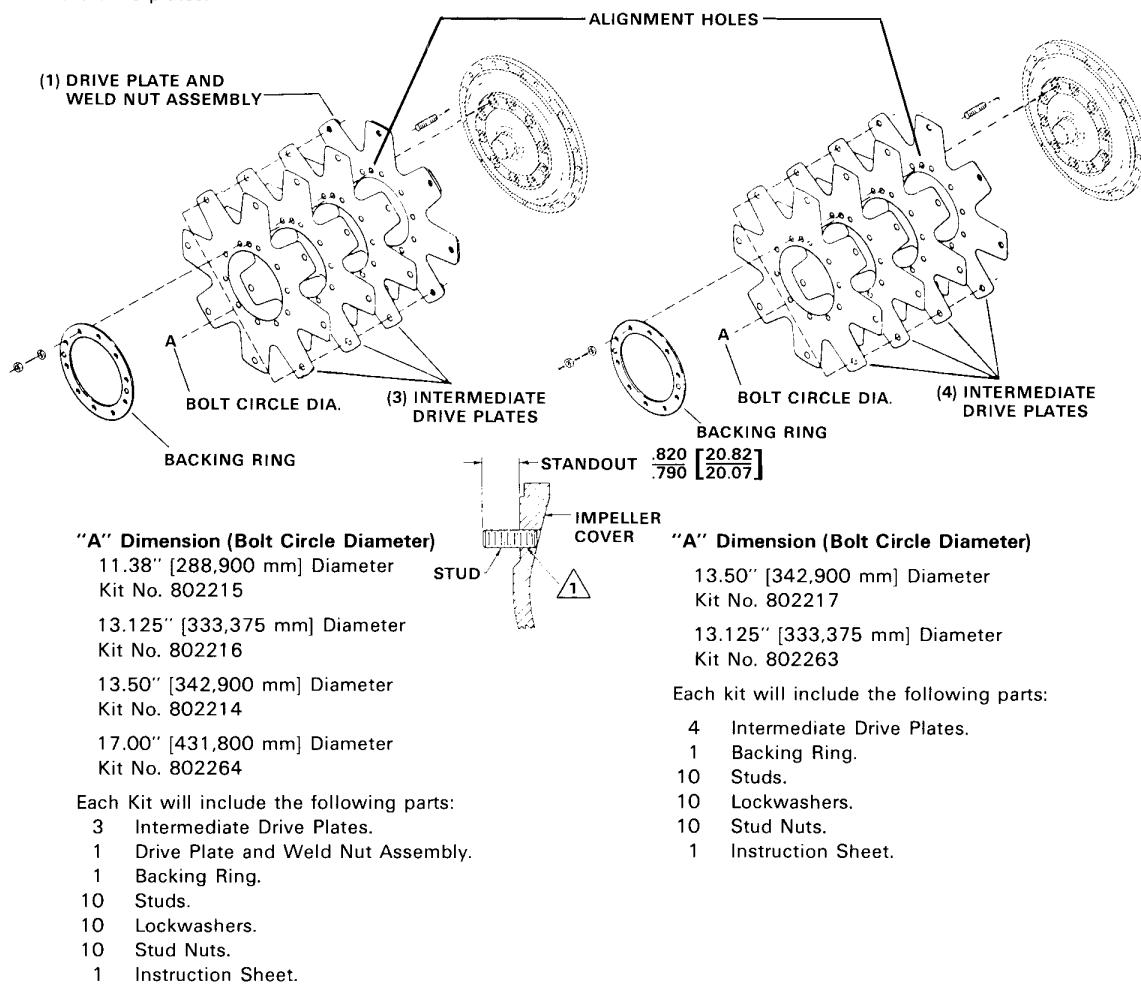
SYSTEM VOLTAGE	CONTROL VALVE ASS'Y.
12 VDC AND 24 VDC	SEE MODEL PARTS LIST

SOLENOID	CAPACITY
240212	12VDC
240224	24VDC

## DRIVE PLATE INSTALLATION

Measure the "A" dimension (Bolt Circle diameter) and order Drive Plate Kit listed below.

Note four (4) kits have three (3) intermediate drive plates and one (1) drive plate and weld nut assembly. Two (2) kits with four intermediate drive plates.



## Drive Plate installation Procedure



TO FACILITATE ASSEMBLY. ALIGN SMALL HOLES IN DRIVE PLATES -SEE ILLUSTRATION ABOVE.

Clean tapped holes and studs thoroughly with Loctite 755 Solvent. Must be free of any grease or oil. Spray Loctite 747 Primer "T.. in tapped holes and on studs and allow to dry. Apply Loctite 262 Threadlocker to both tapped holes and (16 NC thread) stud end. Assemble to standout shown. Remove excess Loctite after assembly. Allow 30 minutes minimum before installing on engine. NOTE: If Loctite 747 Primer ..T.. is not used, allow 24 hours for the threadlocker to cure before installing on engine.

Position drive plate and weld nut assembly on impeller cover studs with weld nuts toward cover. Align intermediate drive plate and backing ring with studs in impeller cover. NOTE: Two dimples 180° apart in backing ring must be out (toward engine flywheel). Instal washers and stud nuts. With a calibrated torque wrench, tighten nuts 26 to 29 ft. lbs. torque [35.3 - 39.3 N.m].

Over for TRANSMISSION TO ENGINE INSTALLATION PROCEDURE

## TRANSMISSION TO ENGINE INSTALLATION PROCEDURE

1. Remove all burrs from flywheel mounting face and nose pilot bore. Clean drive plate surface with solvent.
2. Check engine flywheel and housing for conformance to standard S.A.E. #3 -S.A.E. J-927 tolerance specifications for pilot bore size, pilot bore runout and mounting face flatness. Measure and record engine crankshaft end play.
3. Install *two* 2.50 [63,50 mm] long transmission to flywheel housing guide studs in the engine flywheel housing as shown. Rotate the engine flywheel to align a drive plate mounting screw hole with the flywheel housing access hole.
- \*4. Install a 4.00 [101,60 mm] long drive plate locating stud .3750-24 fine thread in a drive plate nut. Align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in step No.3.
5. Locate transmission on flywheel housing aligning drive plate to flywheel and transmission to fly wheel housing.

NOTE: Fig. 4 installation, align drive plate holes with flywheel studs. Install transmission to flywheel housing screws. Tighten screws to specified torque. Remove transmission to engine guide studs. Install remaining screws and tighten to specified torque.

- \*6. Remove drive plate locating stud.
7. Install drive plate attaching screw and washer. Snug screw but do not tighten. NOTE: Fig. 4 in stallation, install drive plate attaching washers and nuts. Tighten each nut 28 to 30 ft. lbs. torque [38,0 40,6 N.m]. Some engine flywheel housings have a hole located on the flywheel housing circumference in line with the drive plate screw access hole. A screwdriver or pry bar used to hold the drive plate against the flywheel will facilitate installation of the drive plate screws. Rotate the engine flywheel and install the remaining seven (7) flywheel to drive plate attaching screws. Snug screws but do not tighten. After all eight (8) screws are installed torque each one 25 to 30 ft. lbs. Torque [33,9 40,6 N.m]. This *will* require torquing each screw and rotating the engine flywheel until the full amount of eight (8) screws have been tightened.
8. Measure engine crankshaft end play after transmission has been completely installed on engine fly wheel. This value must be within .001 [0,025mm] of the end play recorded in step No.2.

\* Does not apply to units having 3 intermediate drive plates. See Fig. 4.

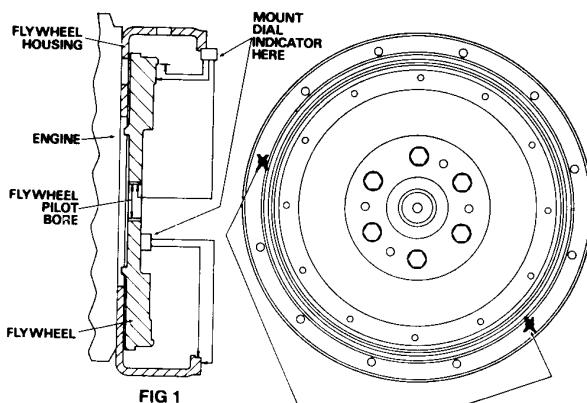


FIG 1

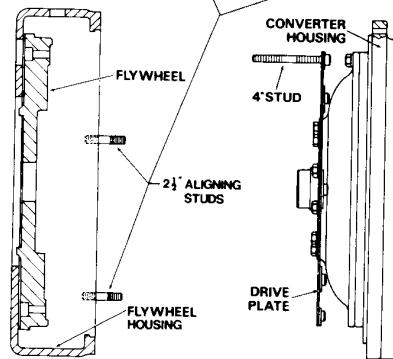


FIG 2

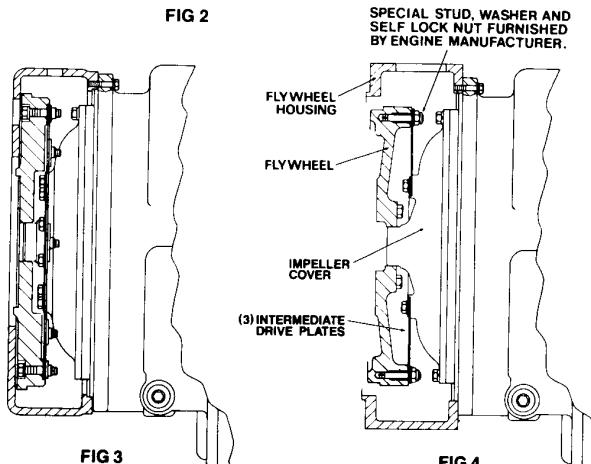


FIG 3

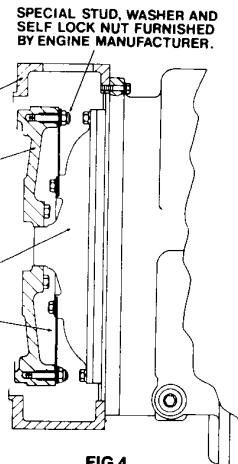
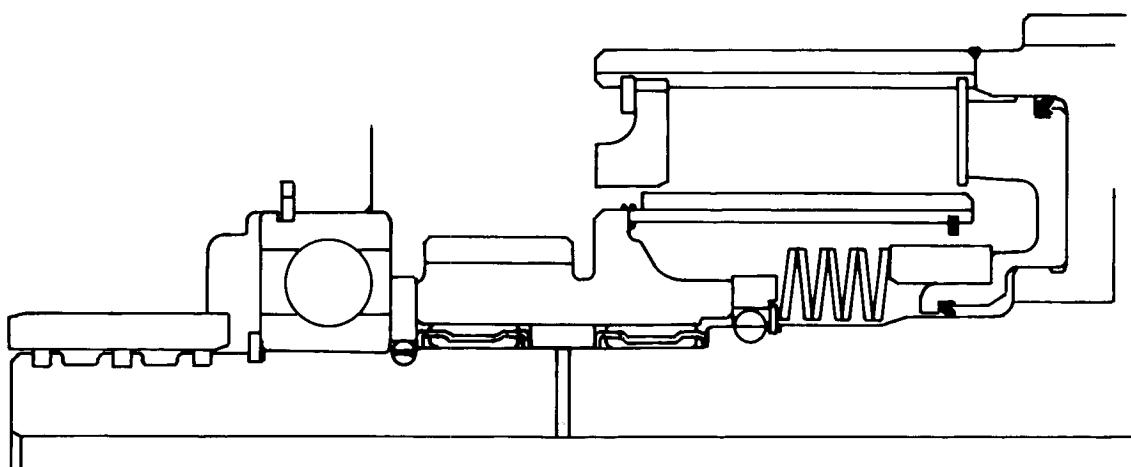


FIG 4

## FORWARD HIGH CLUTCH WITH SPECIAL RATIO



NOTE: The disc spring packs are to be used as complete assemblies and care should be taken not to intermix the individual disc springs with disc springs in another clutch or disc spring pack.

Each disc spring assembly is made up of selected springs to precisely match each part

within this assembly. Failure to replace all piston return springs can result in unequal deflection within the spring pack. The result of this imbalance may adversely affect overall life of springs.

Service replacement assemblies are banded together and must be replaced as assembly.

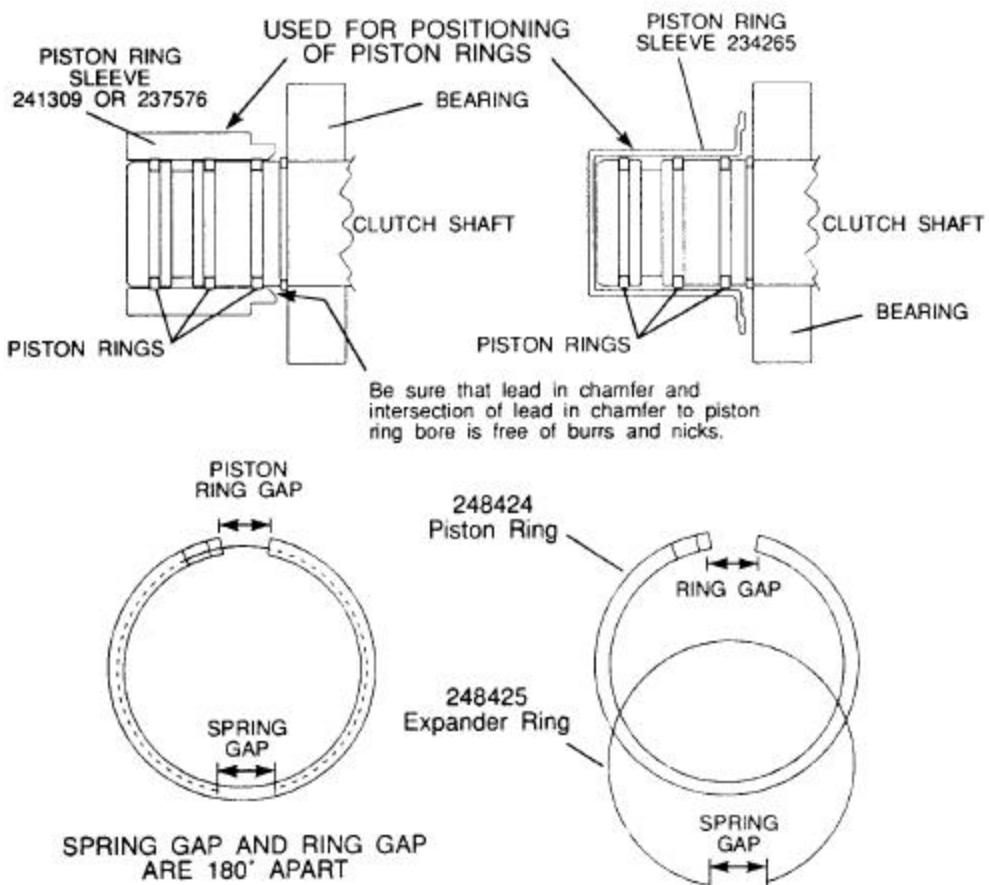
24000

## PLUMBING DIAGRAM WITH LOCK-UP

## PROPER INSTALLATION OF TEFLON PISTON RING AND PISTON RING EXPANDER SPRINGS

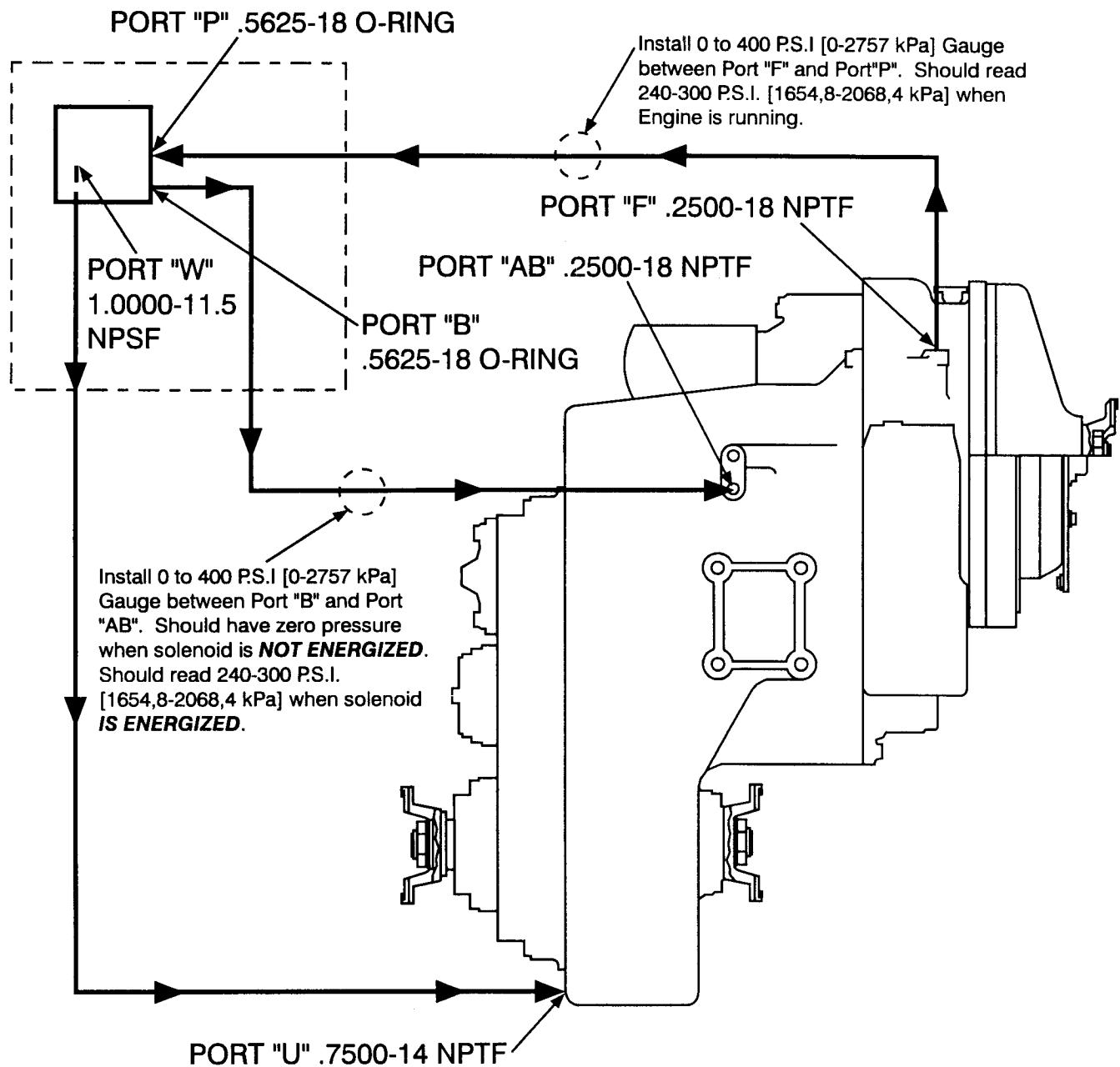
NOTE: NOT ALL TRANSMISSIONS WILL HAVE TEFLON PISTON RINGS AND EXPANDER SPRINGS

1. Fill the oil sealing ring grooves with a good grade of grease, this will help stabilize the teflon ring and expander spring in the ring groove for installation.
2. Position the expander spring in the inner groove of the new piston ring, with the expander spring gap 180° from the hook joint gap of the piston ring.
3. Carefully position the piston ring and expander spring on the clutch shaft in the inner most ring groove. Hook the piston piston ring joint.
4. Repeat steps 1, 2 and 3 for the remaining ring or rings making certain all hook joints are fastened securely.
5. Apply a heavy coat of grease to the outer diameter of the rings and clutch shaft Center the piston ring's in the ring groove
6. Before installing the clutch assembly in the front cover or converter housing it is recommended a piston ring sleeve PIN's 241309, 237576 or 234265 be used to center all of the piston rings in their respective ring grooves. Use extreme caution to not damage piston rings when installing the clutch shaft in the front transmission cover or converter housing.



24000

## PLUMBING DIAGRAM WITH LOCK-UP



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